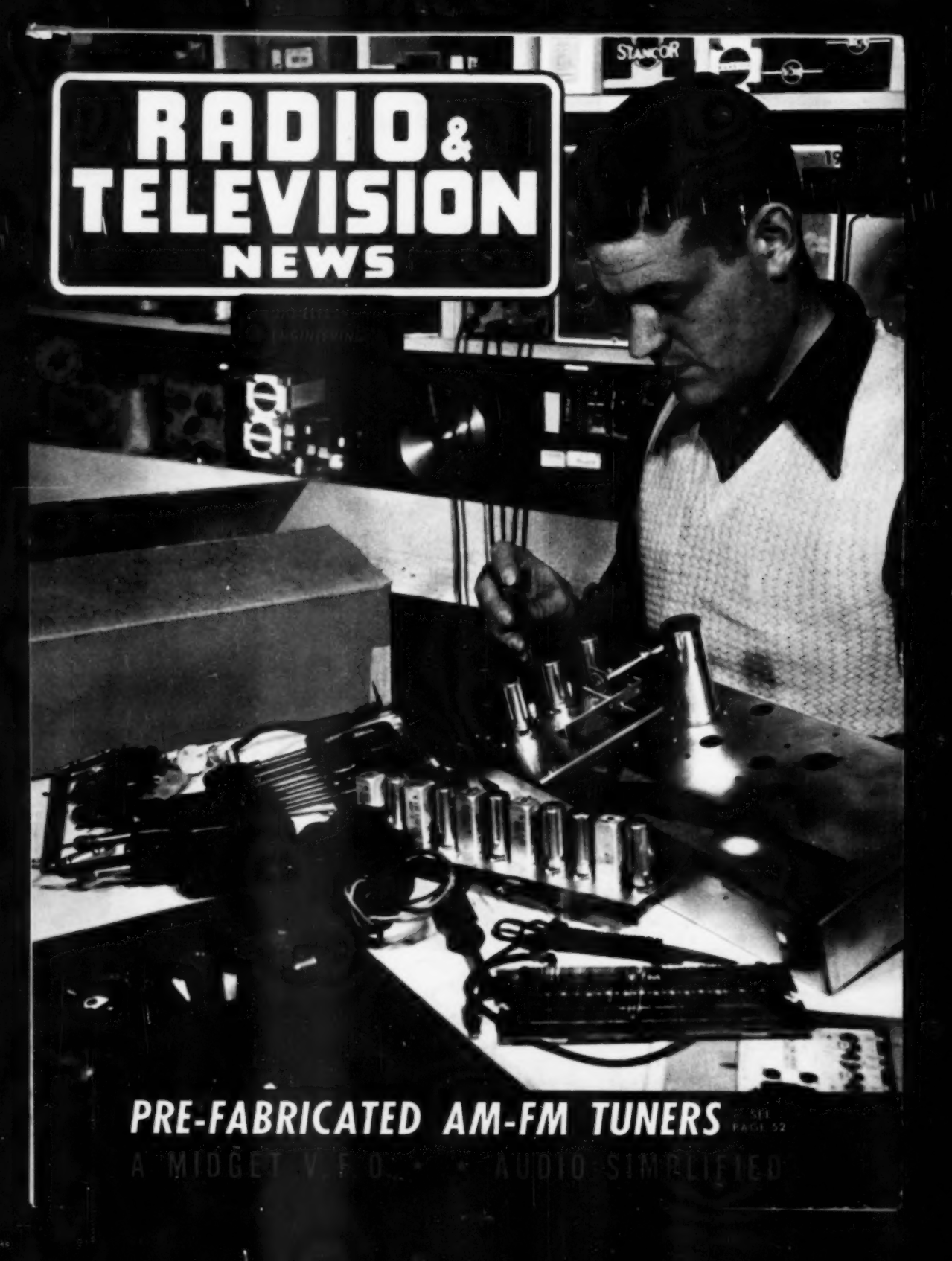

RADIO &
TELEVISION
NEWS
STANCOR
PRE-FABRICATED AM-FM TUNERS
SEE PAGE 52
A MIDGET V.F.O.
AUDIO SIMPLIFIED



Cathode and control-grid assembly

The gun that looked 100% "perfect"

. . . yet never "fired a shot"

The electron gun you see looks perfect, but actually it "never fired a shot." You see, RCA rejected it because the spacing between grid No. 1 and the cathode was out of bounds. Only a 0.001" departure from the design value for this spacing is sufficient cause for gun rejections in RCA factories.

Why does RCA prescribe such a close tolerance? Simply because RCA engineers have found that if the cathode-to-grid spacing is too small, or too large, the grid would have faulty "control." Such tubes, when installed in TV receivers, may be the cause of poor picture performance, and may result in troublesome and time-consuming service problems and call-backs.

RCA takes no chances with its reputation for quality. You get the benefit of RCA's quality reputation when you use RCA tubes. Constant vigilance and *quality control* at *all* stages of manufacture assure meeting RCA standards on the final production line. That's why RCA picture tubes are unmatched for reliability and uniformity.

In RCA picture tubes, the difference is *top-quality* control. That's why, dollar for dollar, RCA picture tubes have no equal.



With RCA Receiving Tubes, as well as RCA kinescopes, TOP-QUALITY CONTROL makes the difference.

RADIO CORPORATION of AMERICA

ELECTRON TUBES — **HARRISON, N. J.**

You Practice COMMUNICATIONS

I send you parts to build this transmitter



As part of my Communications Course you build this low power broadcasting transmitter, learn how to put a station "on the air," perform procedures demanded of Broadcast Station operators, make many tests.



This is just part of the equipment my students build. You keep all parts I send.

You Practice Radio SERVICING

on this modern radio you build with parts I send

As part of my Servicing Course, I send you the speaker, tubes, chassis, transformer, loop antenna, EVERYTHING you need to build this modern, powerful Radio Receiver! I also send parts to build many other Radio circuits. You use equipment for practical experience and to earn EXTRA money in spare time.



BE A RADIO-TELEVISION TECHNICIAN

NOW! Advanced Television Practice

Now, special TV kits furnished to build high-definition SCOPE . . . RF OSCILLATOR with flyback power supply . . . complete TV set . . . many other units. You see pulse, trapezoidal, saw-tooth wave forms. Get valuable PRACTICAL EXPERIENCE locating and correcting TV troubles. Mail coupon for facts, pictures and prices!

Learn Servicing or Communications Practice at Home in Spare Time



J. E. SMITH, President
National Radio Institute

Do you want good pay, a job with a bright future and security? Would you like to have a profitable shop or store of your own? If so, find out how you can realize your ambition in the fast growing, prosperous RADIO-TELEVISION industry. Even without Television, the industry is bigger than ever before. 90 million home and auto Radios, 3100 Broadcasting Stations, expanding use of Aviation and Police Radio, Micro-wave Relay, Two-way Radio for buses, taxis, etc., are making opportunities for Servicing and Communications Technicians and FCC-Licensed Operators.

Television is TODAY'S Good Job Maker

In 1950, over 5,000,000 TV sets sold. By 1954, 25,000,000 TV sets estimated. Over 100 TV Stations now operating. Authorities predict 1,000 TV Stations. This means more jobs, good pay for qualified men all over the United States and Canada.

Many Make $10 Extra a Week in Spare Time

Keep your job while training. Hundreds of successful RADIO-TELEVISION TECHNICIANS I trained had no previous experience, some only a grammar school education. Learn Radio-Television principles from illustrated lessons. Get PRACTICAL EXPERIENCE—build valuable multitester—experiment with circuits common to Radio and Television. Keep all equipment. Many students make $5, $10 extra a week fixing neighbors' Radios in spare time. SPECIAL BOOKLETS start teaching you the day you enroll.

Send Now For 2 Books FREE—Mail Coupon

Send now for my FREE DOUBLE OFFER. You get actual Servicing lesson to show you how you learn at home. Also my 64-page book, "How to Be a Success in Radio-Television." Read what my graduates are doing, earning; see equipment you practice with at home. Send coupon in envelope or paste on postal. J. E. SMITH, President, Dept. 2CE, National Radio Institute, Washington 9, D. C. Our 39th Year.

I TRAINED THESE MEN



"I have been operating my own Servicing business. In two years I did $14,000 worth of business; net profit $6,850. Have one full time employee, an NRI student."—PHILLIP G. BROGAN, Louisville, Ky.



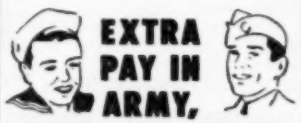
"Four years ago, I was a bookkeeper, with a hand-to-mouth salary. Now I am a Radio Engineer with a key station of the American Broadcasting Company network."—NORMAN R. WARD, Ridgefield Park, New Jersey.



"When halfway through the NRI course, I made $5 to $8 a week fixing sets in my spare time. Am now selling and installing Television sets and antennas."—E. J. STREITENBERGER, New Boston, O.



"My first job was operator with KDLR, obtained for me by your Graduate Service Dept. I am now Chief Engineer of Police Radio Station WQOX. I never hesitate to endorse NRI."—T. S. NORTON, Hamilton, Ohio.



EXTRA PAY IN ARMY, NAVY, AIR FORCE

Knowing Radio, TV, Electronics can help you get extra rank, extra prestige, more interesting duty at pay up to several times a private's base pay. You are also prepared for good Radio-TV jobs upon leaving service. Mail Coupon TODAY.

Have Your Own Business

Many N.R.I. trained men start their own Radio-Television sales and service business without capital. Let me show you how you, too, can be your own boss, have a good income from your own shop. Send coupon for FREE book now!

Tested Way to Better Pay

Good for Both—FREE

The ABCs of SERVICING



MR. J. E. SMITH, President, Dept. 2CE
National Radio Institute, Washington 9, D. C.

Mail me Sample Lesson and 64-page Book about How to Win Success in Radio-Television. Both FREE. (No Salesman will call. Please write plainly.)

Name ..... Age .....

Address .....

City ..... Zone ..... State .....

Approved for training under G. I. Bill

Editor
OLIVER READ, D.Sc., D.Litt.

Managing Editor
WM. A. STOCKLIN, B.S.

Technical Editor
H. S. RENNE, M.S.

Associate Editor
HAROLD BECKER

Midwest Editor
RAY FRANK, W9JU

Assistant Editor
P. B. HOSFER

Television Consultant
WALTER H. BUCHSBAUM

Short Wave Editor
KENNETH R. BOORD

Staff Artist
FRANK SAYLES

Chief Draftsman
B. L. NEWMAN, W9ROB

Advertising Manager
L. L. OSTEN

Midwest Adv. Manager
JOHN A. RONAN, JR.

Western Adv. Manager
JOHN E. PAYNE

Color Art Editor
HERMAN R. BOLLIN



COVER PHOTO: Assembling a Collins "Pre-Fab" unit. Pre-punched chassis and pre-assembled circuits simplify the construction, particularly for the beginner.
(Anaco color photo by R. E. Collins)

Chairman of the Board and Publisher
WILLIAM B. ZIFF

President
B. G. DAVIS

Secretary-Treasurer
G. E. CARNEY

Vice-Presidents
M. H. FROELICH

H. J. MORGANROTH
Production Director

LYNN PHILLIPS, JR.
Advertising Director

H. G. STRONG
Circulation Director

LOUIS ZARA

BRANCH OFFICES
CHICAGO (1)
185 N. Wabash, AN 3-5200

LOS ANGELES (14)
815 S. Hill St., Tucker 9215

First in radio-television-electronics
Average Paid Circulation over 200,000

RADIO & TELEVISION NEWS
Reg. U.S. Pat. Off.

Radio News Trademark Reg. U. S. Pat. Office ● Television News Trademark Reg. U.S. Pat. Office

CONTENTS — MARCH, 1952

Radio Control on the Citizens Band	Vernon C. MacNabb	35
The Loudness Control—An Aid to Higher Fidelity	Ron Pickett	38
Selling Maintenance—And Yourself	Yvon O. Johnson	40
Problems of Indoor Antenna Reception	E. M. Noll & M. Mandl	42
A Midget V.F.O.	W. W. Purvis, W3QQA	43
The Electronic Brain "Codetyper"	Nathaniel G. A. Dorfman	46
Corner Loudspeaker Enclosure	Richard H. Dorf	48
A Low-Cost Audio Amplifier	Frederic T. C. Brewer	50
"Pre-Fab" Tuners	W. H. Collins	52
150-Watt Universal R.F. Amplifier	John F. Clemens, W9ERN	53
Crystal Diodes in Modern Electronics (Part 6)	David T. Armstrong	56
High Quality 50-Watt Amplifier	James Baumgardner	58
Electrostatic Focus for Picture Tubes	Walter H. Buchsbaum	62
Interlacing Troubles and Vertical Sync Circuits	John K. Frieborn	64
A Dual-Channel AM Receiver	Glen Southworth	66
Saturable Reactors	Erwin Levey	68
Mac's Radio Service Shop	John T. Frye	70
Audio Simplified (Part 7)	David Fidelman	72
Check That Picture Tube	F. C. Kroeger	84
Radio-TV Service Industry News		100
Folded Long Wires	Bob Perthel, W9MWD	125

DEPARTMENTS

For the Record	The Editor	8	What's New in Radio	94
Spot Radio News		16	Technical Books	131
Within the Industry		24	Manufacturers' Literature	134
Short-Wave	K. R. Boord	71	New TV Products	156

VOLUME 47 • NUMBER 3

Member
Audit Bureau of Circulations

Editorial and Executive Offices, 366 Madison Ave., New York 17, N. Y.

RADIO & TELEVISION NEWS is published monthly by the Ziff-Davis Publishing Company at 185 N. Wabash Ave., Chicago 1, Illinois. Entered as second-class matter July 21, 1948, at the Post Office, Chicago, Ill., under the act of March 3, 1879. Entered as second-class matter at the Post Office Department, Ottawa, Canada. Postmaster—Please return undelivered copies under Sec. 3509 to 64 E. Lake St., Chicago 1, Ill.

SUBSCRIPTION RATES. RADIO & TELEVISION NEWS—in U.S., Canada, Mexico, South and Central America, and U.S. Possessions, $4.00 for twelve issues; in British Empire, $5.00; all other foreign countries, $5.00 for twelve issues. RADIO-ELECTRONIC ENGINEERING EDITION—in U.S., Canada, Mexico, South and Central America, and U.S. Possessions, $6.00 for twelve issues; in British Empire, $7.00; in all other foreign countries, $7.00 for twelve issues. SUBSCRIPTION SERVICE. All communications concerning subscriptions should be addressed to Circulation Dept., 64 E. Lake St., Chicago 1, Ill. Subscribers should allow at least two weeks for change of address.

CONTRIBUTIONS. Contributors are advised to retain a copy of their manuscripts and illustrations. Contributions should be mailed to the New York Editorial Office and must be accompanied by return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Any copy accepted is subject to whatever adaptations and revisions are necessary to meet the requirements of this publication. Payment covers all author's, contributor's, and contestant's rights, title, and interest in and to the material accepted and will be made at our current rates upon acceptance. All photos and drawings will be considered as part of the material purchased.

Copyright 1952 by Ziff-Davis Publishing Company. All rights reserved.

NOW . . . GET EVERYTHING YOU NEED TO LEARN AND MASTER

TELEVISION

RADIO-ELECTRONICS ...AT HOME!

Use REAL commercial-type equipment to get practical experience

Your future deserves and needs every advantage you can give it! That's why you owe it to yourself to find out about one of the most COMPLETE, practical and effective ways now available to prepare AT HOME for America's billion dollar opportunity field of TELEVISION-RADIO-ELECTRONICS. See how you may get and keep the same type of basic training equipment used in one of the nation's finest training laboratories . . . how you may get real STARTING HELP toward a good job or your own business in Television-Radio-Electronics. Mail the coupon today for complete facts — including 89 ways to earn money in this thrilling, newer field.



ABOVE: Build and keep a real 17 INCH commercial TV receiver. Optional after completing regular training at moderate added cost.

D.T.I., ALONE, INCLUDES BOTH MOVIES and HOME LABORATORY

In addition to easy-to-read lessons, you get the use of HOME MOVIES — an outstanding training advantage — plus 16 big shipments of Electronic parts. Perform over 300 fascinating experiments for practical experience. Build and keep real commercial-type test equipment shown at right

Get BOTH of these information packed publications FREE!



MODERN LABORATORIES

If you prefer, get all your preparation in our new Chicago Training Laboratories—one of the finest of its kind. Ample instructors, modern equipment. Write for details!

MILITARY SERVICE!

If you're subject to military service, the information we have for you should prove very helpful. Mail coupon today.

Here's the REAL THING!

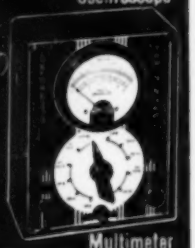
SET UP YOUR OWN HOME LABORATORY


R-F Signal Generator


Oscilloscope


6-Tube Radio

Home Movies


Multimeter





ACT NOW! MAIL COUPON TODAY!

DE FOREST'S TRAINING, INC. Dept. RN-3-I
2533 N. Ashland Ave., Chicago 14, Ill.

Without obligation, I would like your Opportunity News Bulletin showing "89 Ways to Earn Money in Television-Radio-Electronics"; also, the folder showing how I may prepare to get started in this thrilling field.

Name.....Age.....

Address.....Apt.....

City.....Zone.....State.....

DeFOREST'S TRAINING, INC.

CHICAGO 14, ILLINOIS

A DeVRY INSTITUTION

LOOK CLOSELY...

and you'll see why They outperform all others!



OHMITE
Little Devil
INSULATED COMPOSITION
RESISTORS

INDIVIDUALLY MARKED AND COLOR-CODED

Each unit is marked with resistance and wattage values, in addition to the color coding. Quick, positive identification — no guesswork or mistaken identity!

RATED AT 70C (158F)

Built to withstand extremes of heat, pressure, and humidity without deterioration. Under full continuous load for 1000 hours, resistance change is less than 5%.

MOLDED PLASTIC COMPLETELY SEALS AND INSULATES

Solid-molded body has high mechanical and insulating strength. Units meet JAN-R-11 requirements, including salt-water immersion and humidity tests.

COMPACT SIZE

ONE-HALF WATT size is only ¾" long, 9/64" in diameter; ONE WATT is 9/16" long, 7/32" diameter; TWO WATT is 11/16" long, 5/16" diameter.

TEMPERED COPPER LEADS IMBEDDED DEEP IN THE BODY

Differential tempering of leads near body prevents sharp bends and resistor damage. Copper leads are locked in—anchored deep in the body for permanence.



SEND FOR BULLETIN 135

Gives complete data and list of RMA values. Includes dimensional drawings and handy color codes.

Look inside an OHMITE Little Devil resistor, then you'll begin to understand why these tiny composition units have become the standard for *dependable performance* among design engineers, servicemen, and amateurs the world over. Packed into each unit is a ruggedness, stability, and current-carrying capacity unmatched by any other on the market. Little Devils come in ½, 1, and 2-watt sizes in ±5% or ±10% tolerance. Furnished in standard RTMA values, 10 ohms to 22 megohms. In 1-watt size, ±10% tolerance, values as low as 2.7 ohms are available.

AVAILABLE ONLY FROM YOUR DISTRIBUTOR

OHMITE MANUFACTURING COMPANY
4884 Flournoy Street, Chicago 44, Illinois

***Be Right with* OHMITE®**

RHEOSTATS • RESISTORS • TAP SWITCHES



Service Clinic!

Engineering information to help you better service Raytheon

VIDEO "PUNCH" AND "SNAP"

The Video Amplifier Response must be capable of resolving the finest picture detail contained in the video signal at present standards. The video amplifier is to respond with uniform gain as near to 4.5 MC as the art will permit. This provides the "snap" in the picture detail. A non-uniform response will cause a phase shift "smear."

The Video Capability must fully drive the picture tube (with full rated HV) from black to maximum brilliance at picture whites. This gives the picture that "punch" that is needed for a full contrast range even in bright daylight. A two stage video insures the necessary drive.

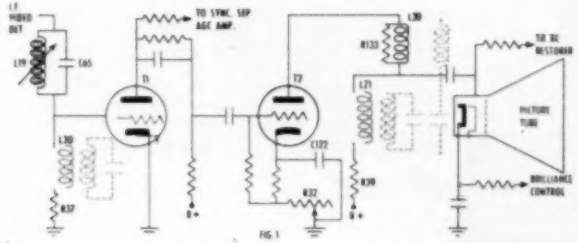


FIG. 1

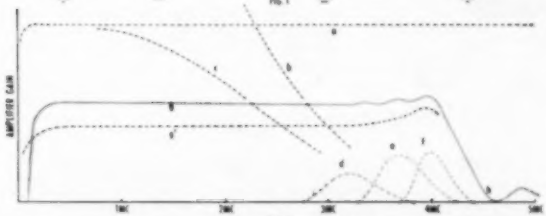


FIG. 2

Video Peaking networks are used to extend the frequency range of a resistance coupled amplifier. The amplifier gain as illustrated in Fig. 2 (Curve a) will be shunted by the capacity at the input grid of the picture tube. Curve b, to form a falling off response (Curve c). A low plate load resistor will extend the response but the stage gain is reduced. However, the tube capacity may be used in series (L 20 and Curve f) or shunt (parallel) resonance (L 21, L 30, Curve e and d) to extend the range of a practical plate load resistor (R 39) to form Curve g. Point h is the 4.5 MC sound trap (L 19 and C 65).

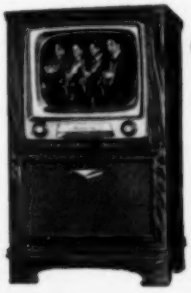
The Plate Load Resistors (R 39 and R 27) will determine the Q or the effecting range of the shunt peaking coils. In series peaking, damping (R 133) may be required to keep the Q down so as to prevent "ringing." A cathode feed-back contrast control (shunted by C 122) will provide added "snap" to the high frequency detail when the contrast control (R 32) is reduced as shown in Curve g.

Improved Circuitry such as this is one of many reasons why you can feel free to recommend Raytheon TV to a friend or customer.

Raytheon TV Presents JOHN CAMERON SWAYZE Sundays on NBC. See local paper for time and station.

©BELMONT RADIO CORP.

RAYTHEON TELEVISION



Dependably Built for Dependable Performance

Guaranteed by Good Housekeeping

THE STARLIGHT—Model RC-1720

Belmont Radio Corp., 3291 W. Dickens Ave., Chicago 39, Ill.
Subsidiary of Raytheon Manufacturing Co.

NEW! 2ND EDITION
of the only complete reference on AUDIO!

"The Recording & Reproduction of SOUND"

by OLIVER READ



Completely revised and vastly enlarged new edition

OVER 800 PAGES

largest selling book in its field

A "Must" for Sound Engineers, Hi-Fi Enthusiasts, P. A. Men, Broadcasting Stations, Recording Studios, Students

CONTENTS:

A Partial List of Authoritative Chapters:

Behavior of Sound Waves; Basic Recording Methods; Lateral Disc Recording; Microgroove Recording; The Decibel; Phono Reproducers; Styli; Microphones; Loudspeakers and Enclosures; Dividing Networks and Filters; Attenuators and Mixers; Home Music Systems; P.A. Systems; Amplifiers; AM and FM Tuners—PLUS HUNDREDS OF OTHER SUBJECTS

Now you can have all the *right* answers to *any* subject in the field of Audio. Learn how to select and get the most out of recording equipment. Tells you how to select the proper amplifier for given applications, how to test amplifier performance, how to eliminate hum. Explains microphone, speaker and pickup principles and selection factors. Shows how to utilize inverse feed-back, expanders and compressors. Covers hundreds of subjects—a vast wealth of reliable information found in no other single volume. If you work in the field of Audio, this book belongs in your library. Order your copy today!

6" x 9" Hard Covers
800 pages 700 illustrations

ONLY $7.95

ORDER TODAY

Order from your Parts Jobber, or write direct to HOWARD W. SAMS & CO., INC. 2201 E. 46th St., Indianapolis 5, Ind.

My (check) (money order) for $..... is enclosed.

Send ..... copy(ies) of *The Recording & Reproduction of Sound* (*RR-2*) $7.95 per copy.

Name.....

Address.....

City.....State.....

For the RECORD

BY THE EDITOR

PRE-RECORDED MAGNETIC TAPE

THE production of pre-recorded magnetic tape is analogous to music on records only in that an original must be reproduced in great quantity and with a minimum of loss in fidelity with respect to the original. We all know how the multiplication of an original disc is achieved through quality-control pressing processes and injection molds. Some twenty million turntables now in use attest to the acceptance of the phono-record. But you can't duplicate an original tape in a pressing machine or in an injection mold.

Up to a year ago there were two or three attempts to market music which was pre-recorded on magnetic tape. Unfortunately for the industry as well as the entrepreneur the products were poor and the enterprises failed. One venture which reached catalogue proportions failed because its production fell far short of the high fidelity standards now demanded of any pre-recorded music.

Industry is literally crying for a tape multiplication technique which is economical in its use of labor time.

The catalogue of tape music which we mentioned before as having failed made use of a technique evolved with the assistance of a development laboratory. The company achieved some interesting results—interesting in that it did turn out copies. The quality of these copies might have been adequate if another phenomenon in American life had not taken place. And that phenomenon is the growth of the high fidelity market—music lovers who insist on distortionless reproduction. With the advent of this phenomenon and the "discriminating ear" which is now in itself a rapidly growing industry, the quality of that pre-recorded tape music caused a public rejection.

Well, what is one to do? Should one invent the barrow before discovering the wheel? If there is no barrow, what good is the wheel? If there is a wheel and no barrow, what to do with the wheel? The analogy is: If there is no one who wants to create a catalogue of pre-recorded magnetic tape music and who is willing to invest in the introduction and marketing of a quality catalogue, how is either the wheel or the barrow to come about? What would then be the encouragement or stimulus for the invention of a tape multiplication technique?

Or, look at it this way: If there had been no such thing as a phonograph record to be played, there would not have been a phonograph player. If there had not been a phonograph player, there would not have been a reason to invent a record presser. When it became practicable to press records economically in quantity, it became commercially feasible to produce record players which were within the means of the general public, again increasing the demand for records and bigger and better process facilities, a cycle that is profitable to industry.

Even though several past attempts to pre-record on magnetic tape have failed, at least one company has invested time, effort, and money with the firm belief that from continued pioneering there would evolve a workable technique that could produce limited quantities of high fidelity tape. *A-V Tape Libraries, Inc.*, New York is doing such a pioneering job. This technique, while not the final answer, does produce copies of original masters that are indistinguishable from the master in fidelity. The technique is, briefly, one of direct, high-speed re-recording from a tape playback machine to a bank of studio tape recorders. The major disadvantage is that the process is long, tedious, and not the most economical way of making long-runs of thousands of copies of one original recording.

We have run tests on and have listened to these pre-recorded tapes and can attest to their excellence. Believing that there will be an ever increasing demand for this medium of recorded music, we are making a complete study of ways and means to promote pre-recorded magnetic tape as the ultimate medium for high fidelity music.

One or two others have already taken steps to develop new processes and techniques for the mass production of tapes. The *Tape Recording Industries* of Lansing, Michigan have submitted selections for our review. Using high-speed re-recording techniques it will be interesting to compare their products with those produced by *A-V Tape Libraries* or by others entering this new field.

Audio enthusiasts will welcome the feature article next month describing and illustrating the technique employed by *A-V Tape Libraries*.

The public has been honestly and well educated to the advantages of magnetic tape. Even before the availability of pre-recorded magnetic tape they had bought over a half million recorders. It will be interesting to chart future sales of record players and tape machines to see how they compete with one another in dollar volume. . . . . O. R.

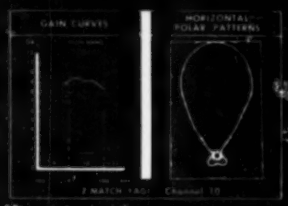
Eliminates mismatch! Outperforms standard Yagis!

Z-MATCH YAGI*

600 Series

Reaches farther for single-channel reception.

- Perfect match to 300 ohm line, single or stacked.
- Wider spaced elements for higher gain.
- 100% gain in stacking!
- Completely preassembled.



*Patent Applied For

How The Z-Match Yagi Works

When antennas are stacked, the center feed bars of the folded dipoles are removed automatically creating a perfect 300 ohm match for the entire stacked Yagi array. These same center bars are then used as half-wave connecting rods. This means

YOU DON'T PAY FOR STACKING BARS!



developed by

CHANNEL MASTER

FIRST IN PREASSEMBLED ANTENNAS

For "Far Reaching" Results

There's only ONE

SUPER FAN

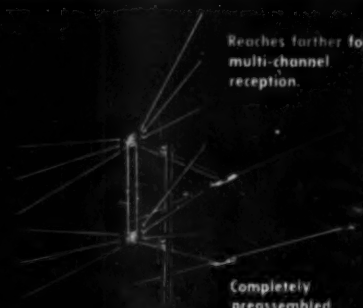
313 Series

The most widely used antenna in the nation.

The highest gain broad-band antenna ever developed.

New reinforced fibreglas inserts in all elements and reflectors.

Reaches farther for multi-channel reception.



Completely preassembled.



new!

TOWERS

by Channel Master

- Steel tubular uprights.
- Built-in ladder with no obstructions.
- One standard interchangeable section which can be used as a top, middle or bottom section.
- Universal base mount.
- Dual purpose mast or rotator mounting brackets.

Write for technical literature on these 3 outstanding products.

CHANNEL MASTER CORP. ELLENVILLE N Y



IMPORTANT ANNOUNCEMENT TO SERVICE DEALERS!

Your used PICTURE TUBES are now worth $2.25 to $5.25

Sylvania Tube Distributors offer trade-in allowance on more than 40 picture tube types . . . of any make.

Here's the best picture tube news you ever heard. It's the Sylvania GLASS ALLOWANCE PROGRAM. You can make $2.25 to $5.25 *more* on every picture tube you sell. You also protect your reputation by installing only new, fully guaranteed Sylvania Picture Tubes in your customers' sets. The process is simple! No strings attached!



Here's all you do!

1. Return old picture tubes to your Sylvania tube distributor. Sylvania has made it possible for him to give you a GLASS ALLOWANCE CREDIT of from $2.25 to $5.25 per used tube on the purchase of any new Sylvania picture tube.
2. Return tubes may be of ANY MAKE but must be types shown on the suggested Sylvania Glass Allowance Price List. (See list below.)
3. Returned tubes must be under vacuum and free from chips, scratches, etc.
4. New tubes purchased need not be the same as those returned. You may choose any type Sylvania has for sale.

Sylvania reserves the right to change cash values or tubes shown on the suggested Glass Allowance Price List. SO ACT NOW. Take your used picture tubes to your Sylvania Distributor . . . TODAY! For further details call your Sylvania Representative or Sylvania Electric Products Inc., Glass Department, Seneca Falls, New York.

Here's your Suggested Glass Allowance PRICE LIST

(Clip this list and keep it handy)

12KP4A	$2.25	17AP4	$2.25	20CP4	$4.25
12LP4A	2.25	17BP4	2.25	20CP4A	4.25
12VP4	2.25	17BP4A	2.25	20DP4	4.25
		17BP4B	2.25	20DP4A	4.25
16JP4A	3.25	17FP4	2.25	20FP4	4.25
16KP4	3.25	17FP4A	2.25	20GP4	4.25
16KP4A	3.25	17HP4	2.25	20HP4	4.25
16LP4A	3.25	17JP4	2.25	20HP4A	4.25
16QP4	3.25	17KP4	2.25	20JP4	4.25
16RP4	3.25	17LP4	2.25	21EP4	5.25
16TP4	3.25	17QP4	2.25	21EP4A	5.25
16UP4	3.25	17RP4	2.25	21FP4	5.25
16XP4	3.25	17SP4	2.25	21FP4A	5.25
16ZP4	3.25			21KP4	5.25
				21KP4A	5.25

SYLVANIA

TRAIN for Security! Good-Paying Jobs!

MAKE THE MONEY YOU'VE ALWAYS DREAMED OF!



LEARN RADIO -TELEVISION

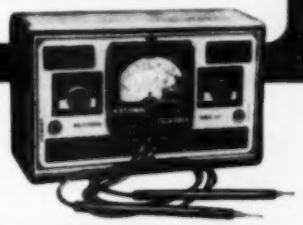
AND ELECTRONICS BY EASY SHOP METHOD TRAINING AT HOME!

You get all the parts—even tubes!— for this modern Superheterodyne Receiver. You learn to build it step by step. And you keep it! Get all the facts. Mail coupon now.

Let NATIONAL SCHOOLS—a resident-training school for nearly 50 years—train you at home for today's unlimited opportunities in Radio-Television-Electronics. National Schools is one of the largest schools of its kind. It is located in Los Angeles—the center of Radio and TV world! It has four large buildings of modern shops and labs. Its faculty is considered tops in the business.



You learn from lessons prepared by experienced instructors and engineers. Men who are successful Radio and Television technicians. Men who have trained 1000's of men like YOU!





FREE BOOK

TELLS YOU HOW!

Page after page—in color—tells you everything you want to know. Mail the coupon. Get this valuable book today. And if you hurry—YOU GET A FREE SAMPLE LESSON, TOO! Shows how easy National Schools Home Training is. Mail the coupon today.

You Train At Home—In Your Spare Time

National Schools Shop Method Home Training gives you basic and advanced instruction in *all* phases of Radio-TV-Electronics. And remember—your training is based on resident school training principles. You learn *fast* from hundreds of diagrams and pictures. All instructions are written by experienced technicians who work in Radio and TV every day. All instructions have been developed and tested in National Schools' own labs and studios, which are equipped with the latest RCA equipment. No wonder this National Schools course is so up-to-date, practical, interesting. And so easy to learn! And no wonder it is held in such high regard by leaders of American industry! Approved for eligible Veterans.

We Teach You How To Make Welcome Extra Money—While You Learn!

Many National Schools students—men like you—make plenty of extra dollars each week in spare time! Fixing neighbors' radios, appliances—and other ways we teach you. You start learning and earning from the day you enroll. From the very first lesson!

Only National Schools Gives You This Professional Multi-Tester!

You get this amazing, new testing instrument—factory-made and tested—complete—ready to use! Simple to operate. Accurate and dependable. An instrument every Radio-TV man needs. Light enough to carry around—so you can use it at home or on service calls. You'll be proud to own this valuable equipment.

Here are only a Few of the Good-Paying Jobs You Can Choose

Radio Station Engineer, District Service Manager, Aircraft Radio Inspector, Own Your Own Repair Shop, Inspector Technician, Service Specialist, Special Government Jobs, Complete TV Service, Sound Truck Operator. Many more!

National Schools graduates have secure, good-paying jobs like these! So don't wait—mail the coupon today. Now—while you're thinking about it!

WE SEND YOU LOTS OF PARTS LIKE THIS!



With National Schools Shop Method Home Training, you get basic principles and plenty of *practical* training. *You learn by doing.* No wonder you learn so fast!

We send you many parts—all of professional, modern quality. You do lots of practical experiments. You advance day by day, step by step. Until you can even build the modern Superheterodyne Receiver you see above—plus other important testing units. The free book tells you all about it. The free sample lesson shows how easy the training is. Use the coupon. Send today — without fail!

Today's Shortage of Trained Technicians Creates Chance of a Lifetime For You!

Think of it! With guided missiles, radar, and other electronic devices so important to national defense! With big, new developments in TV. With over 90,000,000 home and auto radios, over 12,000,000 TV sets. With more than 3100 radio stations....over 100 TV stations—and more building every day...yes, imagine the great opportunity you have today!

YOU are wanted in Radio-Television-Electronics! America's fastest-growing field. High-pay jobs—the kind you've always wanted—are waiting for YOU!

Job Security! Big Money! For YOU! in Today's Expanding Industries!

Trained Radio and Television technicians really make important money these days. Thousands of National Schools graduates—men just like you—are earning good money all over the country. Why not you?

And—National Schools graduates get the personal satisfaction of being highly-skilled technicians. Men people respect. Men who enjoy their work—rather than having to drag along in just any old job.

National Schools Has Trained 1000's of Successful Men! Why Not YOU?

In almost every state—and many foreign countries—National Schools graduates are filling big jobs with famous companies. Or running their own successful businesses. What are YOU waiting for? National Schools training is *complete* training. So when you graduate you can take advantage of today's big opportunities in Radio-Television-Electronics—fast.

Attention! Men Going into Service Soon!

National Schools' course quickly prepares you for many important jobs in the Armed Services. With National Schools Training you have an opportunity to get into *special* service classifications—with higher pay and grade—immediately!

FREE SERVICE FOR GRADUATES

National Schools uses its great influence and prestige to help you find your place in the field of your choice. Don't put it off! Start yourself toward a skilled trade! Get the big pay you've always wanted!

NATIONAL SCHOOLS

LOS ANGELES 37, CALIFORNIA • ESTABLISHED 1905

In Canada: 193 Hastings St., Vancouver 4, B.C.

DON'T PUT IT OFF! GET THE BIG SALARY YOU HAVE ALWAYS WANTED!

MAIL THIS COUPON TODAY—WITHOUT FAIL!

NATIONAL SCHOOLS, Dept. MR-32
4000 South Figueroa Street
Los Angeles 37, California

Mail in envelope or paste on penny post card.

Mail me FREE the book mentioned in this ad. Also a free sample lesson. I understand no salesman will call on me.

NAME ..... AGE .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

☐ Check here if you were released from the Service less than 4 years ago.

What kind of men?



What kind of men are the 2500 scientists and engineers of Bell Telephone Laboratories?

They are men of many types, yet they work well together, for all have good minds as a foundation, years of study in the fundamentals of their science and in the methods of research and design. Vital, too, is their teamwork — for without the co-operation of many individuals the products of research and development could never be perfected.

Above all else these men have "the spirit to adventure, the wit to question, and the wisdom to accept and use."

Such men can develop the world's finest telephone systems — and have done so.

Perhaps there is a place among them for you. Write the Employment Director, Bell Telephone Laboratories, New York 14.

BELL TELEPHONE LABORATORIES

• EXPLORING AND INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE



"OUR FASTEST SELLING SPEAKER LINE FOR THE PAST 7 YEARS!"

Quality Product Plus Smart Promotion Spell Success for Aggressive Parts Jobber

"My dealer customers don't bother to open the cartons – as they do with other brands – before buying G-E speakers. They know that General Electric factory-packed Alnico units come to them in perfect shape, ready for use. Customer confidence pays off. Because I stock all 27 G-E models, my dealers know I can fill any speaker need."

What Dave Marks does not mention is that his merchandising skill has made him one of the top parts distributors in the East. He makes frequent and profitable use of all G-E sales tools: catalogs, booklets, envelope stuffers, display pieces of all kinds. They're available to you, too, through your General Electric distributor or representative. Call him today for your share of these sales helps.



Drive-In Theatre Speaker Sales Hot! With G.E.'s special weather-tested outdoor speaker, Dave Marks, shown here with general manager Ted Sharaf, has increased his drive-in business four times over in two years!

DEALERS AND SERVICEMEN

Here's a complete new service manual on all General Electric television receivers – 102 models manufactured since 1945! You get 80 pages packed with circuit diagrams, symbols and numbers, tube locations, top and bottom chassis views. Plus photographs and lists of service aids. Mail coupon for it today. Only $1.00.



General Electric Company, Section 932
Electronics Park, Syracuse, New York

Send me _____ copies of the new 80-page service manual on General Electric TV receivers at $1.00 each. I enclose $ _____

☐ Check ☐ Money Order

NAME _____

ADDRESS _____

CITY _____ STATE _____

GENERAL ELECTRIC

PRESENTING

COLLINS

AM-FM "PRE-FAB" TUNERS

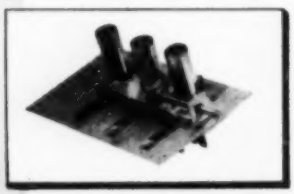
***NOW** you can build a Collins AM-FM tuner from the Pre-Fab units shown below!*

COMPLETE VERSATILITY is the byword in this new tuner design. Through the addition of the AM circuit, the Collins tuner will meet all requirements for home music systems and installations where a fine tuner is required.

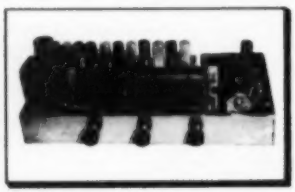
ECONOMY: The very finest in tuner design is offered you at exceptionally low prices. Collins quality is your assurance of a fine product that will work to your complete satisfaction. You cannot duplicate this tuner in its completed form at *twice the price!*

3 Ways to purchase COLLINS Tuner . . .

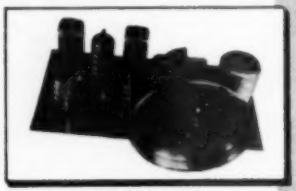
1. **As an AM tuner kit**
2. **As an FM tuner kit**
3. **As an AM-FM tuner kit**



FM Tuning Unit $15.25



The Collins FM-AM Pre-Fab Tuner Kit As It Looks After You Assemble It (Total Kit Cost $69.00)



AM Tuning Unit (Includes IF and Audio Amplifier) $19.25



FM IF Amplifier $19.75

Tuning Eye Kit Available At $2.85



UC-2 Universal Chassis Kit $14.75

ALL PRE-FAB UNITS ARE ASSEMBLED, WIRED, TESTED, AND ALIGNED AT FACTORY. PRICES SHOWN INCLUDE TUBES.

The FM tuning unit employs a 6J6 dual triode RF amplifier; 6AG5 converter, and 6C4 oscillator. Permeability tuned, stable, and drift-free. High sensitivity of between 6 and 10 microvolts. Dimensions: 7¼"x4½". The IF amplifier for FM uses 6 tubes! 6BA6, (4) 6AU6, and 6AL5 discriminator. High gain, wide band response for highest fidelity reception. Frequency response of FM section, plus or minus 2 DB, 20 to 20,000 cycles. Distortion less than ½ of 1%. Dimensions: 11⅛"x2½".

The AM tuning unit utilizes a super-het circuit employing three tubes: 6BE6 converter, 6BA6 IF amplifier, and 6AT6 detector. Extremely high sensitivity and selectivity is accomplished through the use of new, high gain iron-core transformers. Careful alignment provides widest response available from this type of circuit. If builder desires, triode amplifier section of 6AT6 tube may be used as first audio stage.

Chassis Kit includes all necessary parts. Nothing else to buy! Instruction Manual included with detailed, step-by-step procedure, pictures and schematic diagrams. Chassis measures 8"x17"x 2½". Overall, the tuner, when assembled, measures 8"x17"x6".

MAIL ORDER COUPON TODAY!

TO: COLLINS AUDIO PRODUCTS CO. INC.
P.O. Box 368, Westfield, N.J.

Enclosed Find ☐ **Check** ☐ **Money Order For**

- ☐ **AM Tuning Unit**
- ☐ **FM Tuning Unit**
- ☐ **FM IF Amplifier**
- ☐ **UC-2 Chassis Kit**
- ☐ **M-1 Tuning Eye Kit**

NAME _____

ADDRESS _____

CITY _____ STATE _____



Today's wary customers want to know *how you do business* as well as *how capable a technician you are.* That's why thousands of Radio and Television Service Dealers across the nation are discovering that, all other things being equal, their status as RAYTHEON *Bonded* Electronic Technicians tips the scales in their favor.



If you don't know how this exclusive Raytheon *Bonded* Program builds customer confidence and good will by cash-protecting your radio and television service 90-day guarantee, *at no cost to you*, you'd better get in touch with your Raytheon Tube Distributor. He'll be happy to tell you whether you can qualify for this important sales aid.

RIGHT...FOR SOUND AND SIGHT

RAYTHEON

RAYTHEON MANUFACTURING COMPANY

Newton, Mass., Chicago, Ill., Atlanta, Ga., Los Angeles, Calif.

Excellence in Electronics

VEE-D-X
Single Channel
BOOSTERS
Engineered for
GREATER POWER
and
SUPERIOR PERFORMANCE

The Sensational
MAST-MOUNTED
ROCKET
• 18 DB Gain
• Easy to Install
• Low in Price



Amplifies signal at antenna height where most favorable signal-to-noise ratio exists. Delivers 18 db gain. Easy to install and low priced. Uses 300 ohm transmission line. Compact control unit fits snugly against back of TV set. $34.95 LIST

original OUTBOARD
BOOSTER



OUT OF SIGHT —
OUT OF THE WAY

For single channel use. Delivers powerful 18 db gain with full 5 megacycle band width. No special tuning tool required. $19.95 LIST

THE LaPOINTE-PLASCOMOLD CORP.
Windsor Locks, Conn.

Gentlemen:
Please send me details on .....the Rocket .....the Outboard.

NAME .....
STREET .....
CITY ..... ZONE ... STATE .....

Spot Radio News

★ *Presenting latest information on the Radio Industry.*

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

TV AND RADIO, which have become such vital forces in our way of life, and won a pre-eminent position in Washington where their power and influence are deeply respected, was accorded a vibrant welcome in the Capitol as Congress reconvened for the new year. Not only were the legislators concerned with the growing strength and effect of the sight and sound arts, but with several pending measures which sought to introduce new types of control. Among the items which seemed to interest most representatives and senators was Senator William Benton's proposal for a National Citizen's Advisory Board on Radio and Television, and Senator Ernest W. McFarland's bill to streamline the FCC. Both had been introduced in earlier sessions with impressive results. The McFarland measure had been "ayed" by the Senate and was up for House approval, when the '51 session concluded. Senator Benton's plan, which had been presented to the Senate Interstate and Foreign Commerce Committees, was slated for many more review conferences.

The advisory board idea has been and still is strongly opposed by many industry groups which have described the suggestion as contrary to American principles of freedom and absolutely unnecessary in the light of the stern new code recently adopted by the broadcasters. One of the strongest opponents of the measure is Dr. Du Mont, who has bitterly criticized the plan on many occasions, noting that station operators are fully capable of policing their programming departments. Describing the care applied in this direction in the *Du Mont* television station operation, the eminent pioneer declared during a hearing on license renewals that . . . "We shall always be alert to the fact that our programs are 'guests' in the homes of viewers, and shall always be guided by principles of programming which will make our programs acceptable and satisfying to families and their components insofar as their interests extend. . . . We shall abide by the television broadcasting code, but this shall not be restrictive in terms of expenditure of efforts to make our standards even higher." He cited the special attention given to programming for children . . . "to encourage a healthy orientation for a child to his social surroundings and develop a respect for his parents." Describing the continuing need for the highest moral standards in all programming formats, Dr. Du Mont said that the policy of *Du Mont* will be . . . "to raise and never lower the educational, moral, cultural, political, and entertainment standards of the average home."

Acknowledging that television was in its infancy and subject to many variables, the picture-tube authority declared that broadcasters have and will continue to adhere to the cardinal principles of diligently serving the public interests.

Not only have many members of industry censured the government-control idea of Senator Benton, but some members of the Commission have voiced their opposition, too. It is believed that these blasts of discontent may alter the views of some of the committee members and perhaps effect a shelving of the move.

A budget problem, circling the TV-radio world, also faced Congress as it got together. The FCC spiraled a request at the legislators that prompted many frowns. They asked for about two million dollars more than they received for the fiscal year '52, or about eight-million as a total appropriation. About $600,000 of this money was needed, it was said, for additional hearing examiners and staff to handle the expected increase in filings and applications for new stations which will certainly result as soon as the freeze is ended. The remainder of the extra dollars was required, explained the Commission, for monitoring stations; a request that had been relayed to the budget committee last summer and denied because of military-fund requirements.

Congressional committees have quite a whirling agenda before them to complete before the hectic presidential-campaign days appear on the scene.

THE EMERGENCY COMMUNICATIONS PLAN, which was approved by the President shortly before the Christmas holidays of '51 and entered in the books as the law of land, has become a priority project of all broadcasters who will be required to obey a series of strict regulations involving perhaps complete silencing when the Air Force believes an air attack is imminent.

Presently, two sets of techniques have been suggested for broadcast sta-

UHF*



All UHF channels... for all TV sets

MALLORY UHF CONVERTER

The Mallory UHF converter is right for *all* your TV customers because it can be used with *any* TV set . . . in *any* UHF broadcast area. And it's easy to install—no adjustments or connections to make in the TV set . . . just connect power lines and antenna leads.

These Mallory features mean real customer satisfaction . . . real sales for you in the new UHF market—

- *Reception of all UHF channels*
- *No sacrifice of VHF channels*
- *Built-in UHF antenna*
- *High quality picture definition*
- *Fast, easy installation*

No larger than a small portable radio, the Mallory UHF converter is precision-built for long, trouble-free service. Get complete details today on the Mallory UHF converter from your Mallory distributor.

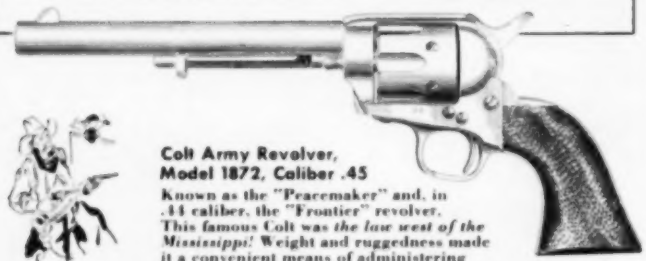
MALLORY CAPACITORS . . . CONTROLS . . . VIBRATORS . . . SWITCHES . . . RESISTORS . . . RECTIFIERS . . . YEARAPACE® POWER SUPPLIES . . . FILTERS

APPROVED PRECISION PRODUCTS

P. R. MALLORY & CO. Inc. INDIANAPOLIS 6, INDIANA

Make Sure... Make it Mallory

Famous Guns



Colt Army Revolver, Model 1872, Caliber .45

Known as the "Peacemaker" and, in .44 caliber, the "Frontier" revolver. This famous Colt was *the law west of the Mississippi!* Weight and ruggedness made it a convenient means of administering a "pistol whipping".



Model 1808 Navy Pistol, Caliber .64,

made by Simeon North of Berlin, Conn. Boarding pistols like this rendered valuable service in the War of 1812. In building them, North actually used a modern mass production technique—*standardized parts!*

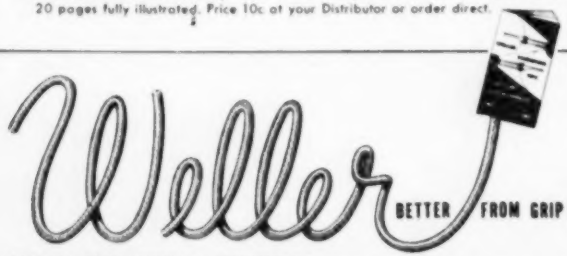




Instant-heating

Weller Soldering Gun for light or heavy work. Dual heat greatly increases tip life. Switch instantly to high or low heat as job requires. Pre-focused spotlights end "blind soldering". Exclusive tip-fastening arrangement assures full, constant heat. High-impact plastic housing. Perfect balance. Low-cost replaceable tips. Pays for itself in a few months. See at your Distributor or write for Bulletin direct.

Get SOLDERING TIPS, new Weller Handy Guide to faster, easier soldering. 20 pages fully illustrated. Price 10c at your Distributor or order direct.



SOLDERING GUNS 810 Packer Street, Easton, Pa.

The Finest Soldering Tool for the Finest Craftsmen

tion procedure involving reduction of power and frequency stages, the latter to be used by stations in single-market areas, and the former to be effected by clusters of stations operating in multiple-transmitter areas. Stations may be obliged to alter their setups through the installation of new crystals and modification of their antennas. It will also be necessary to have emergency standby power. Most operators have indicated that the changes should not be too difficult to make. Since standby power is a feature at most transmitter plants, no difficulties are anticipated.

Amateurs will also play quite a role in the emergency plan. The Commission has proposed a Civil Emergency Service for the hams which would permit the boys to provide radio communication for civil defense purposes on a local, area, and national basis. The new rules state that those now holding ham tickets should apply for additional authorization to operate in the new service. Authorizations will be granted upon the express understanding that the grant is subject to change or cancellation at any time, without hearing, if at the discretion of the Commission, the action is necessary for national defense and security.

In Philadelphia, a striking demonstration of the operation of one of the key links in the communication plan, civil defense mobile radio, was offered recently. On view was a bomb-proof, insulated, air-conditioned 28-foot van, equipped with a 10-kilowatt emergency power supply, 70-watt public-address system, a two-way system, four sets of antennas, walkie-talkies, a sixteen-line-phone board, cables, and transmission-line reels. The two-way setup provided contact to all police cars and also with police headquarters. In addition, it was possible to make contact with fire equipment and fire base stations. Even planes, flying overhead, could be reached on a special CAA-assigned frequency. Hams operating mobile transmitters were also contacted. According to the CD authorities, it will be possible to receive and transmit on three amateur channels and reach over one-hundred hams who operate mobile facilities within the city, and a hundred-odd more who are just beyond the city limits. Contact with broadcast stations operating AM, FM, and TV facilities was also described as being possible from the emergency center, believed to be the first of its kind in the country.

COMPONENT SHORTAGES, particularly on the resistor and selenium-rectifier front, which it has been said may become acute, received a bright, hopeful appraisal recently in Washington, when it was disclosed that European sources could supply millions of resistors, potentiometers, and rheostats, and a substantial supply of selenium cells, too. The surprising information was uncovered by Ed Morris, Jr., serving as chairman of the

(*Continued on page* 96)

RADIO-ELECTRONIC Engineering SECTION

RADIO & TELEVISION NEWS

Reg. U.S. Pat. Off.

TELEVISION • RADAR • ELECTRONICS • RESEARCH • COMMUNICATIONS • MICROWAVE



MARCH, 1952

MAGNETIC TAPE DATA-RECORDING SYSTEMS
3

ETCHING—A GENERAL FABRICATION TECHNIQUE
7

WAVE GUIDE CALORIMETER
10

REMOTE CONTROL FOR FM BROADCASTING
13

HIGH SPEED CRYSTAL CLUTCH
15

EXALTED-CARRIER SINGLE-SIDEBAND RECEPTION
16

POWER DISSIPATED IN WATER-COOLED DEVICES
22

DEPARTMENTS

PERSONALS 2
NEW PRODUCTS 22
NEWS BRIEFS 24
NEW LITERATURE 26
TECHNICAL BOOKS 28
CALENDAR 28

Copyright, 1952, by Ziff-Davis Publishing Co.

RADIO-ELECTRONIC ENGINEERING is published each month as an editorial section in a limited number of regional RADIO & TELEVISION NEWS. Issued by Ziff-Davis Publishing Company, 366 Madison Avenue, New York 17, N. Y.

Editor

E. H. Traeger, Audio & Video Products Corp., N.Y.C., is demonstrating the Ampex Model 300 2-speed component tape recorder which will record all NAB-approved recorder frequencies used in FM-FM intercasting. Top frequency response is 100 kc at 60 inches per second.



TYPE BH6A
RANGE 1.4 - 75.0 mc
Supplied per Mil type CR-18, CR-19, CR-23, CR-27, CR-28, CR-32, CR-33, CR-35, CR-36 when specified.

It's Knowledge

A finished crystal unit, by Bliley, typifies the accumulated know-how of 21 years experience. This includes craftsmanship and engineering methods and techniques, production and quality.

Such **knowledge** is gained **only** from actual experience. It's basic with Bliley, and, your assurance of complete satisfaction.



TYPE AR2W RANGE 0.080 - 0.19999 mc Supplied per Mil type CR-15, CR-16, CR-29, CR-30 when specified.



TYPE MC6 RANGE 1.0-10.0 mc Supplied per Mil type CR-5, CR-6, CR-8, CR-18 when specified.



TYPE SR5A RANGE 2.0-15.0 mc Supplied per Mil type CR-1A when specified.



TYPE TCO-1 Temperature Control Oven.

BLILEY ELECTRIC COMPANY
UNION STATION BUILDING
ERIE, PENNSYLVANIA

Personals



PAUL BARON has joined the Instrumentation Division of *Audio & Video Products Corporation*, New York, N. Y., as field engineering representative. Mr. Baron's experience as an engineer includes work at the *Raymond Rosen Engineering Products Company* and the *Eckert Mauchly Computer Corporation*. He has done considerable original work with magnetic tape recording and electronic circuitry in analog computer type devices.



WILLIAM F. CASSEDY, JR. has been elected president of *Aircraft Radio Corporation*, Boonton, N. J., designer and manufacturer of radio and electronic equipment. He succeeds Lewis M. Hull, who will now serve as chairman of the board and treasurer. Mr. Cassedy, previously vice president and general manager of *Kearfott Manufacturing Company*, has had long experience in manufacturing electrical and mechanical instruments.



SAUL DECKER has been promoted from assistant to chief television engineer of *CBS-Columbia*, manufacturing subsidiary of *Columbia Broadcasting System*. In his new capacity, he will be responsible for design and development of all television and radio chassis. Prior to joining *CBS-Columbia*, Mr. Decker was associated with the *Garod Radio Corporation*, and was employed as a consultant by *Allen B. DuMont, General Television Corporation*, and others.



LEWIS GORDON, newly-appointed managing director of the International Division of *Sylvania Electric Products Inc.*, joined the organization in 1931 as the Lighting Division's New York City district manager. He served in various management capacities before being named to head *Sylvania's* international sales activities. Mr. Gordon is a member of the Export Committee of the Radio & Television Manufacturers Association.



ANTHONY B. LAMB has been appointed vice president in charge of manufacturing at *Weston Electrical Instrument Corporation*, Newark, N. J. Mr. Lamb, who started with Weston in 1924 as an instrument assembler, became a vice president in charge of their Tagliabue Instruments Division in 1950. A pioneer in the field of photoelectricity, he holds a Personal Achievement Award from the U. S. Navy for developing special instruments.



DR. L. C. MARSHALL, Professor of Electrical Engineering at the University of California and head of the Microwave Laboratory operated there, has now been appointed director of *Link-Belt Company's* new physical testing and research laboratory at Indianapolis. Active in radar research for many years, he collaborated with Dr. D. H. Sloan to develop the Resnatron microwave oscillator which holds the record for power output.

Magnetic Tape DATA-RECORDING SYSTEMS

By ROBERT ENDALL

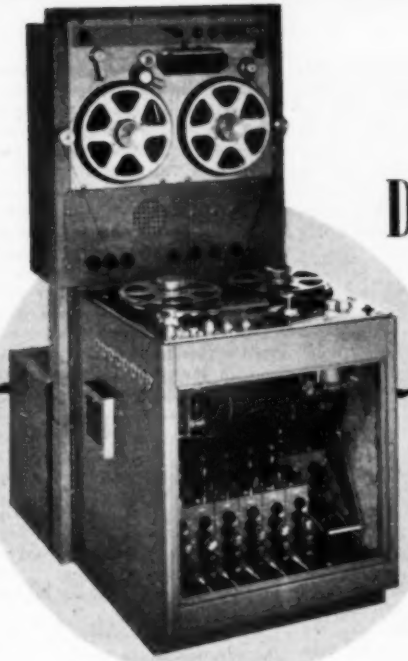


Fig. 1. Commercial laboratory signal-analysis reproducer. Ampex Model S-3037, has 3-speed drive, 8-track reproduction.

Information can be recorded and stored reliably and conveniently by means of magnetic tape.

MANY OF the most important applications of electronics in military, scientific, and industrial problems require a simple and effective method of recording the data which are the results of measurements. Such data may be obtained as measurements of industrial processes, as telemetering information from remote positions, as measured results of scientific and engineering experiments, or from any other of numerous applications of this type in which it is desirable to have a record of the measured data. Such records are useful not only for maintaining permanent records of the data, but also in that they allow detailed analyses of particular sections.

Many different methods have been used to record this type of information. These methods have included oscilloscope photography, disk recording, and ink-chart recording. However, none of these methods has been completely satisfactory from the viewpoints of convenience and simplicity of operation, reliability and reproducibility of results, and frequency response.

With the development of magnetic tape recording, a method became available for the recording of information and data which avoids the limitations and drawbacks of the previous methods. Magnetic tape makes available a simple, convenient and reliable method of recording information with the desired speed and frequency response on tape which can be easily stored, transported and played back at any later time.

Magnetic recording methods are extremely well suited to this type of service, and possess several important advantages over other methods of data recording:

(1) A large amount of information can be stored on a relatively small volume of tape.

(2) The recorder is compact and rugged; therefore, it can be used under adverse conditions and in locations where other types of recorders cannot be used.

(3) The cost of tape recording equipment is low—both initially and in operation. The major part of the analysis system need not be taken on location, and the tapes can be played back under laboratory conditions.

(4) The tapes can be played back indefinitely without loss of information.

(5) The fact that tape can be erased and re-used allows monitoring of processes which would otherwise not be economical. The recorder can be run almost indefinitely in order to obtain one good record.

(6) Simultaneous recordings can be made of several events on one tape, and these records analyzed individually so that only one set of recording and analyzing equipment is necessary.

These relative advantages make magnetic tape recording one of the most valuable techniques which exists for the recording of data.

Because of the wide variety of problems which involve the recording and storage of data for future study and analysis, a number of different magnetic tape data-recording systems have been developed to meet the different requirements of the various applications. For example, some applications require the recording of the results of a measurement at extremely high speed with very good high-frequency response, others might require recording the result of a single measurement for a long period of time with moderate frequency response, while a great many applications require the recording of several different sets of data simultaneously to maintain the exact time relationship between them. The design of the different recording systems will, of course, be quite different depending upon the type of data for which they are to be used. This article will illustrate some of the design principles of magnetic tape recording by describing the essential elements of several basic systems for recording on standard commercial magnetic tape a number of simultaneous sets of data.

The recording of single-channel information also has many important uses. However, multichannel systems may have all the features of single-channel systems and be at the same time much more versatile and general



Fig. 2. A mechanical switch, the ASCOP Model 1-30-30B high speed multichannel commutator.

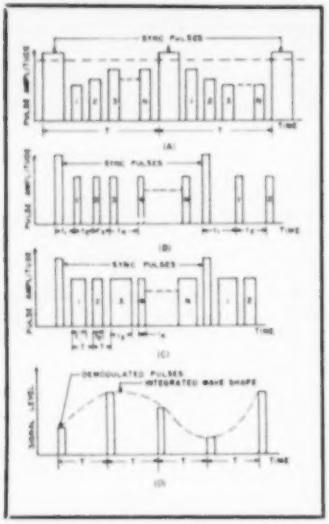


Fig. 3. Typical time-division pulse trains for different types of pulse modulation systems. (A) Pulse amplitude modulation. (B) Pulse time modulation, and (C) Pulse width modulation. (D) Signal in each channel after playback and demodulation in any time-division multiplex system, showing integration of pulse amplitudes to give original signal.

in their application. Therefore, this article will particularly emphasize the multichannel systems and consider the single-channel systems as special applications.

There are several possible methods for recording several simultaneous information channels on the same magnetic tape. These methods fall within the general classifications of:

(a) *Time-division methods*, in which the various signals are recorded on a single channel by sampling the various channels in succession, using a sampling or switching device;

(b) *Frequency-division methods*, in which the various signals are recorded on a single channel by modulation of a number of different subcarriers in a multiplex system;

(c) *Space-division methods*, in which the various signals are recorded on a single magnetic tape in adjacent tracks by means of multiple-track recording systems.

Each of these methods may be employed in a number of different ways, depending largely upon the requirements of the specific applications and the manner in which the original data is derived. Considerable work has been done in developing and perfecting systems of recording by each of these methods.

The basic time-division method of recording or transmitting information is that in which the information in the various channels is sampled in sequence by means of some sampling or switching device. This may be done by either a mechanical or an electronic switch. The signal which is to be recorded will, therefore, consist of a series of pulses, each of which represents the magnitude of a single channel at that particular instant of time. As in other fields of information transmission and communication, many different systems may be used for coding the pulses so that they contain the desired information. The most commonly used systems of pulse modulation are:

(1) *Pulse amplitude modulation*, in which the amplitude of the pulse is proportional to the magnitude of the signal being represented;

(2) *Pulse time modulation*, in which the time position of the pulse (relative to a fixed set of time reference pulses, or to the preceding pulse) is proportional to the magnitude of the desired signal;

(3) *Pulse width modulation*, in which the duration of the pulse is varied by the signal;

(4) *Pulse code modulation*, in which the magnitude of the data signal is converted into a sequential group of pulses representing a binary code.

The system of pulse amplitude modulation is the least complex, and requires the simplest circuit techniques.

A block diagram of the basic system of time-division multichannel recording is shown in Fig. 4. The various input signals are amplified (if necessary) and applied to the inputs of a commutation sampling device. The commutator may be either a mechanical or an electronic multichannel switch. The output signal from the commutator consists of a series of pulses of one of the types shown in Fig. 3. In pulse amplitude modulation systems the various pulses have essentially constant width and position, but vary in amplitude; in pulse time modulation systems all the pulses will have constant amplitude (except for the synchronizing or reference pulse), but their relative time position will vary; in pulse width modulation systems the amplitude and relative time position of the pulses remain constant, with the pulse duration varying. Pulse code modulation is essentially a specialized form of pulse amplitude modulation (or of any of the other systems).

The resulting series of pulses is now a single-channel signal which can be amplified by the recording amplifier and recorded by a standard commercial recorder upon magnetic tape. When the tape is played back at any later time,

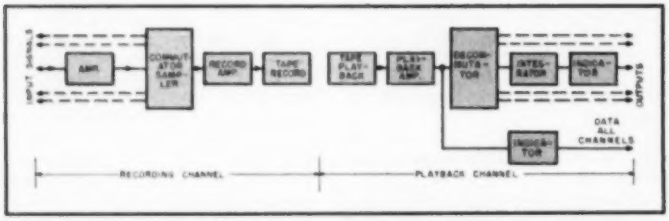
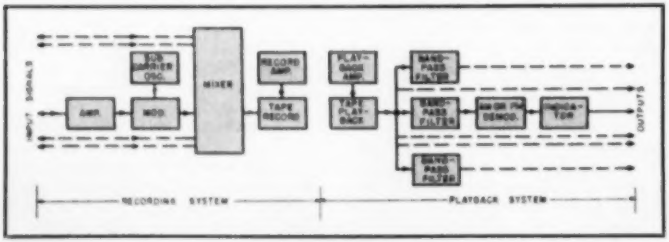


Fig. 4. Block diagram of the basic system of time-division multichannel recording.

Fig. 5. Block diagram of basic system of frequency-division multichannel recording.



this signal (after suitable amplification) must then have the pulses separated into the correct channels. The decommutator for performing this function will generally be an electronic switching circuit which can be properly synchronized, since a mechanical switch would have too much inertia for correct synchronization.

After the pulses have been demodulated, the information they contain is in the form of pulses as shown in Fig. 3 (D). These pulses must be integrated in order to deliver the original signal again as a continuous waveform. By the sampling theorem, if the time interval between pulses is T, then the highest frequency component which can be reproduced is $\frac{1}{2}T$ cycles per second (although a higher number of samples is, of course, preferable for high-accuracy systems). This limitation determines the requirements of the commutator switching system and of the tape recorder. Mechanical switches are generally commercially available which are capable of as many as 60 contacts at rates up to 60 rps—*i.e.*, 3600 contacts per second—and experimental switches have been able to sample as many as 12,000 contacts per second. Thus, assuming 3600 contacts per second with each alternate contact left blank to give break-before-make isolation between adjacent channels, and connecting the contacts in groups to give maximum frequency response in each channel, a ten-channel system would then be sampled ever 1/180 second per channel, while a five-channel system would be sampled every 1/360 second per channel. This would permit a frequency response up to 90 cps for the ten-channel system, and up to 180 cps for the five-channel system. When the required frequency range falls within the limits obtainable with such switches, it is often simplest and most convenient to use mechanical commutation, inasmuch as these switches are compact, reliable, quite versatile because of the many wiring combinations possible, and result in simpler circuits than electronic switching methods. A photograph of a standard commercial sampling switch designed to sample 60 contacts at rates up to 60 rps is shown in Fig. 2. When better high-frequency response is required, and for systems where this type of switching is not applicable, electronic switching circuits must be used. Practical electronic commutator systems have been developed which can provide 16 data channels with 6400 information samples per second in each channel.

The frequency response required from the magnetic tape recorder depends primarily upon the switching rates of the commutator. When mechanical

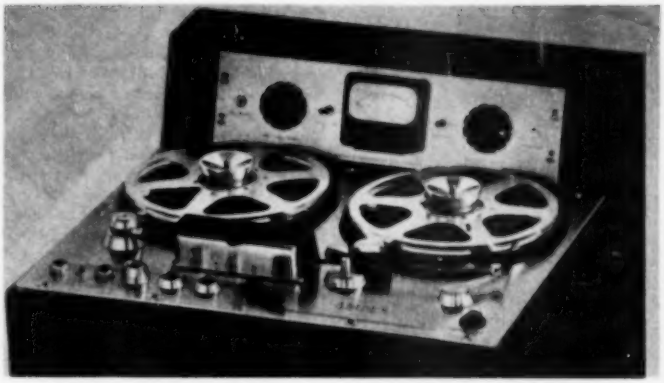


Fig. 6. The Ampex Model 302 single-channel recorder. This unit will cover all telemeter channels up through 40 kc. Frequency response ± 3 db from 350 to 80,000 cps.

switches are used, their output information can be recorded by standard commercial units with a frequency response up to 10 kc. When electronic commutators are used, higher frequency response is required. Fig. 6 shows a photograph of a commercial magnetic tape recorder having a frequency response of ± 3 db from 350-80,000 cps, which is sufficient to reproduce signals from high speed electronic commutators.

The basic frequency-division method makes use of a number of subcarrier oscillators of different frequencies which are modulated by the signals to be recorded, and the modulated subcarriers are then combined into one composite signal which can be recorded on a single recording channel. The modulation may be either AM or FM, depending upon the requirements of the system and the characteristics of the tape recorder. The basic block diagram for frequency-division multiplex systems is shown in Fig. 5. The various input signals are amplified (if necessary), and each is then applied to the modulation input terminal of the subcarrier oscillator. The most commonly used type of modulated oscillator circuit for this service is the multivibrator. The modulated subcarriers are then combined in a mixing circuit which may, in the simplest case, consist simply of a number of resistors properly connected to add the various signals together and give proper isolation between the different channels. The composite mixed signal is then applied to the input of the tape recorder amplifier and recorded on the magnetic tape.

When the composite multiplex signal is played back, the various signals are separated into the correct channels by bandpass filters. The carriers are then demodulated by the appropriate type of detectors, whose outputs can be read on an indicator, recorded or displayed in any desired manner.

The frequencies of the individual oscillators and the required over-all frequency response of the tape recorder will depend upon the highest frequency components which are of interest in the signals being recorded. In both AM and narrow-band FM the modulated bandwidth is on the order of twice the modulating frequency; therefore, the recorder shown in Fig. 6 could accommodate a 16-channel multiplex system with a frequency response which depends upon the subcarrier frequencies selected for each channel. The choice

Fig. 7. The Ampex Model S-3024, a 13-channel system for recording and reproducing signals obtained in petroleum and similar geophysical applications.



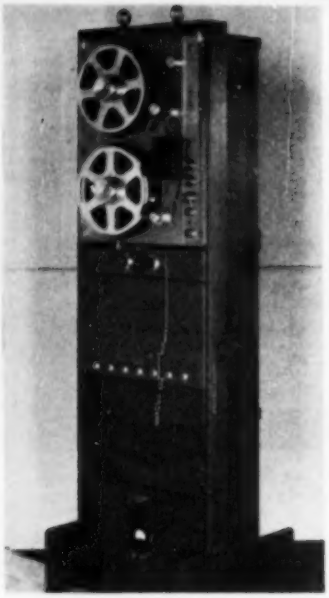


Fig. 8. The Ampex Model S-3041, a typical multitrack unit which records seven channels on a ½-inch magnetic tape.

between the use of AM or FM depends mostly upon the requirements of the particular application. Signals which vary at a slow rate (for example, up to 10 cps modulation) can be recorded with better than 0.5% accuracy on standard commercial tape recorders of the type used for radio broadcast recording.

However, the more common systems make use of frequency-modulated carriers, and the recording is then independent of tape and recording head characteristics. Particularly when high frequencies above about 15 kc. are being recorded, AM systems are not too useful for good accuracy, because high-frequency amplitude changes of as much as 50 or 60 per cent loss may be caused by inconsistencies in the magnetic tape coating material. FM systems avoid this difficulty, since amplitudes are limited to a fixed level.

Because the deviation used in most such systems is generally about ±7.5% of center frequency, the motional stability requirements on the tape drive are very severe, and only machines having very low flutter and wow can be used. Best results from frequency-modulated subcarriers are obtained by the use of electronic compensation for motional instabilities. Electronic compensation consists of recording one unmodulated carrier, and feeding the output of this channel to all the other channels, properly matched in amplitude and out of phase to cancel out the components generated by the flutter. The use of such compensation systems can reduce the flutter noise by a factor of four or greater. Because such compensation requires additional circuit complexity, considerable effort has been put into the design of tape recorders which are capable of better than 0.5% to 1% accuracy without the use of electronic flutter compensation. A commercial tape recorder, showing less than 0.04% peak-to-peak flutter on a typical test run and rated at 0.1% peak-to-peak flutter, is available.

In space-division recording methods the various signals are recorded side-by-side in adjacent magnetic tracks on a single tape by means of multiple recording heads. When this system is used, each signal can be recorded with the maximum frequency range and signal-to-noise ratio of which the recorder is capable, since it is essentially a single-channel recording. Commercial units which have been designed for this type of service are capable of recording as many as seven tracks on ¼-inch tape, and fourteen tracks on 1-inch tape, with crosstalk of −60 db or better between adjacent channels.

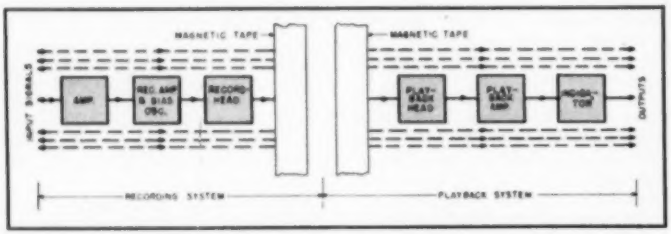
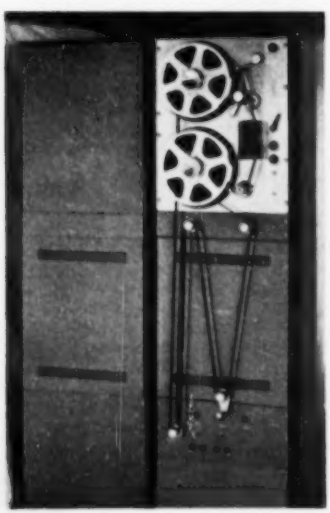
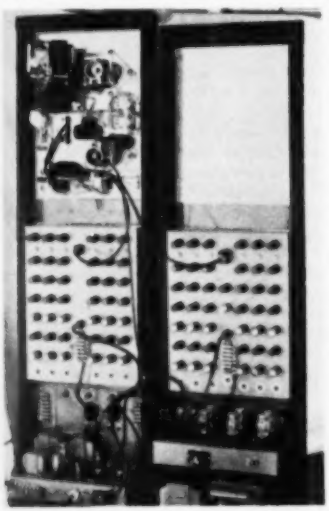


Fig. 9. Basic system for recording a number of independent channels on a single tape.

Fig. 10. Front and rear views of the Ampex Model S-3025, a 13-channel reproducer.





The basic multitrack recording system is shown in the block diagram, Fig. 9, and can be seen to consist essentially of a number of independent recording-reproducing channels, except that a common bias and erase generator may sometimes be used. Each channel contains a low-level amplifier (if one is necessary, depending upon the input signal level) and the recording amplifier. The playback channel contains a low-level amplifier and a high-level amplifier supplying sufficient signal power to drive the indicator or other units which display the signal in any desired manner. Since each recording channel is completely independent, the maximum frequency range and signal-to-noise ratio of such a channel can be attained in recording the required information. Systems are commercially available capable of recording multiple tracks with frequency response of ±3 db from 200 to 80,000 cps, signal-to-noise ratios of 40 db below 1% harmonic distortion, for 16-minute or 32-minute recording time.

Many applications require the recording of signals which contain frequency components down to zero cps. Such signals cannot be recorded directly

(*Continued on page* 30)

ETCHING - A GENERAL FABRICATION TECHNIQUE



Fig. 1. An a.c.-d.c. receiver having an etched loop and connective wiring.

By
W. H. HANNAHS
and
J. A. CAFFIAUX

Physics Laboratories
Sylvania Electric Products Inc.

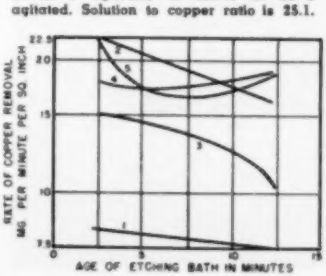
This technique permits saving many man-hours in the fabrication of circuit components and connectives.

IN MINIATURIZATION of electronic circuits and equipment, the reduction of man-hours needed to fabricate equipment is of extreme importance. A saving in skilled help is particularly urgent today in view of its scarcity and the growing demand caused by vastly extended application of electronics to new fields, both military and civilian.

The great demand for electronic equipment, both present and future, can best be met by the development of automatic assembly methods using miniaturized and standard components as desired. The efforts of Brunetti and Henry in devising methods for silk-screening of fuze amplifiers and i.f. strips have notably encouraged the introduction into industry of printed *R-C* assemblies for hearing aid and TV use. Abramson and Danko have shown also that simpler techniques, such as the solder pot dipping of pre-assembled components, may be more useful even though involving hand operations. In the latter technique, as in those reported here, the use of more conventional components is stressed with the emphasis placed on more convenient methods of assembling them into the end product. It is probable that total elimination of hand labor is still a far-off objective but a considerable saving may be had by product design, the use of printing techniques, and proper tooling without a complete dislocation of traditional manufacturing.

The possibility of improving on hand wiring was apparent at least as early as 1883 when H. W. Breckenridge invented a switchboard wiring panel involving a criss-crossed system of wires imbedded in a non-conductor. During the intervening years, many other schemes have been devised to provide a prefabricated system of connections for improving final assembly operations. In addition to conductive inks fired on steatites and the selective etching of copper-clad laminates, both of which methods are now well known, attention might be called to die-cut connections, the hot spraying of metal through stencils, and the blanking of wiring grids. The war-time exploitation of pre-laced and formed wire harness is in this category and has emphasized the fact that the more elementary techniques often have more extensive practical application when all requirements are considered.

Fig. 2. Curves showing effects of various control factors in copper etching with ferric chloride. 1. 41.5% concentration at 22°C not agitated; 2. 41.5% at 22°C agitated; 3. 41.5% at 42°C agitated; 4. 37.0% at 22°C agitated; 5. 43.7% at 22°C agitated. Solution to copper ratio is 25.1.



The complexity of electronic products requires that the design, the process, and the tooling be closely integrated to achieve an efficient method. However, if the three are too closely tied together, the resultant method often lacks flexibility of application. These primary considerations have entered into the development of printed circuit methods reported in this paper, which treats the laboratory development of etching techniques and test methods.

At the present time, considerable industrial attention is being given to a process for producing electrical connective harness and components by the selective etching of copper foils bonded to plastic laminates. U.h.f. coils, capacitors, and connective wiring can be produced on a surface which is substantially two-dimensional. Holes punched through the laminate permit the insertion of leads from standard components. These leads are thus presented for convenient hand soldering or, in some instances, they may be dip-soldered. The pattern which is acid-etched is determined by a resist of organic coating material put on the copper by a variety of graphic arts and methods such as pen drawing, silk screening, use of a rubber roller, or photography.

While the application of etching to the fabrication of electronic components



Fig. 3. Samples of etched broadcast loop antennas on plastic film.

and circuits has been reported in a number of journals, not much attention has been given to the process itself. The underlying idea of protecting a desired geometrical metal design with a resist or stop-off during a removal process was patented in 1888 and is an old technique in the fine arts and decorative fields. Since copper-clad laminates are of interest in etched-circuit fabrication, three methods of processing the laminates for use as electronic products have been worked out in the laboratory. In all of these the general procedure is to apply a protective coating of chemical resist to those areas of the copper which are to be retained.

In the first method, the resist is an ink and any of the regular means may be used to apply the circuit pattern directly to the copper.

In the second method, the copper surface is completely covered with a resist and a stylus is used to scribe those portions of the copper designated for removal.

In the third method, the resist is a photo-sensitized colloid to which the design is transferred photographically from a negative.

The first and third methods are generally used to manufacture electronic products today, particularly by concerns which have for many years used graphic arts etching for the production of signs, name plates and similar decorative items.

The etching of copper is, of course, a well established art in printing and engraving, and Method 3 is used daily for producing newspaper cuts and halftones in large volume. This photographic method offers great flexibilty in design and is capable of an ultimate definition of at least 1000 lines per inch when copper of one mil or under is used. However, it is somewhat slow, being intrinsically a batch process, and the cost of resist is rather high. With copper etching stock, a practical limit to line width may be assumed at about .015" due to variations encountered in etching a long, narrow strip. Larger quantities of etched products can undoubtedly be produced by utilizing an etch-resisting ink (Method 1) applied by means of a silk screen, printing press, or other graphic arts method, but there is no direct evidence that such a method is in use.

Preparation of Surface

In printing and lithography a great amount of attention is given to proper cleaning of the metal surface before any resist is applied. The purpose of this cleaning is two-fold: first, to prepare what will later be the printing surface for the proper retention of ink, and second, to promote adhesion of the resist. Only the second objective is of immediate concern for our purposes. While nitric acid etching has been tried for cleaning the copper surface, abrasive methods have been found more convenient and quite suitable. A satisfactory way of preparing the etching stock is to scrub it lightly with a moistened paste of calcium carbonate, or levigated alumina. The abrasive is washed away in running water and the cleanliness checked by observing whether or not a continuous film of liquid forms on the surface. Drying is accomplished by spinning at 78 rpm under a heat lamp.

Application of Resist

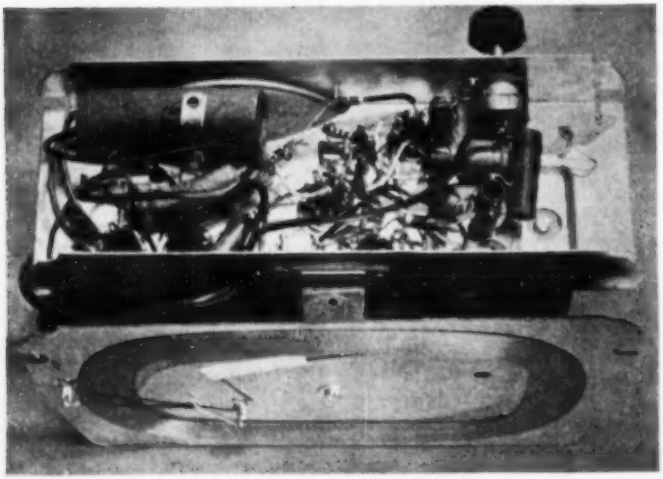
While resists for the three different methods previously mentioned must have slightly different qualities, a common requirement is a resistance to "lifting" or porosity in the etching bath.

The resist used in the first method must behave properly with a ruling pen, dispose itself on the copper surface without running or contracting into drops, and otherwise conform to the requirements of an ink. For this purpose an opaquing ink has been found quite suitable.

In Method 2, and where the design is to consist of relatively wide copper areas separated by narrow spaces, it has been found convenient to use another type of resist in which the "spaces" may be scribed with a sharp, pointed tool. For this purpose the entire copper surface is rinsed with a quick-drying organic solvent after being cleaned, and then lacquered by spraying or brushing. Dykem steel blue, a layout lacquer, has proved satisfactory. If the coating is sprayed, it should be done in two thin layers, and if brushed on, by application of two coats at right angles in order to avoid pin holes. The design may be cut with a scriber or a narrow chisel-edge tool, using conventional drafting guides. After etching, the resist may be removed with alcohol.

In the third method, a very large amount of work has been done in the development of photo-sensitive stop-offs for the making of printing surfaces, and many variations of such material exist. The suspending media most frequently used for photo-sensitive bodies fall into categories which are typified by albumin, glue, shellac and, recently, polyvinyl alcohol. Evolution in the third class of coating has resulted in a group of materials, known to the trade as "cold top enamels," which have wide popularity in preference to the other materials because they require less caution and treatment to prevent undercutting during etching.

Fig. 4. Under-chassis view of conventionally wired a.c.-d.c. receiver.



The original circuit design is laid out 2-5 times its size on glossy bristol board with India ink. This is reduced by photographing it to actual size on a high contrast "process negative" film, such as halftone film., The exposure of the sensitized plate under the negative may be made in an ordinary photo print frame, but is preferably done in a vacuum frame to insure close contact between the negative and the sensitized surface over which it is placed. The exposure varies somewhat with the environmental conditions as well as with the average density and contrast in the negative. The "development" of the cold top enamel consists of a drying and very slight hardening action of a weak dye-alcohol-water solution in which the exposed pattern is placed for a few minutes, followed by a complete washing out of the unexposed sensitized areas under cold running water. The developed pattern is then dried with forced air which may be warmed to approximately 100°F. The design is now ready for etching.

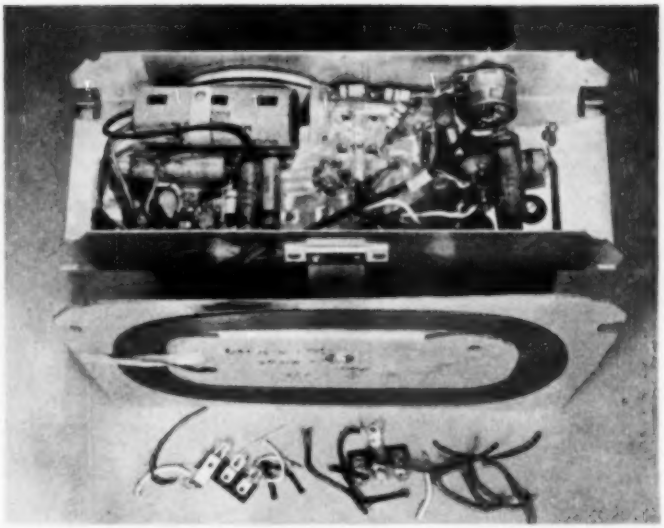


Fig. 5. Intermediate stage in simplification showing etched connective wiring.

Etching

One of the more easily controllable materials used in etching is ferric chloride solution. The plate maker alternately etches with nitric acid formulations or ferric chloride solution, but since the latter is easier to control and permits use of less critical resists, it has been the most common etchant applied to component fabrication. Ferric chloride is obtainable in 41.5% solution, ready for application, and some interesting parameters of its use in etching copper are expressed in Fig. 2. Curve 2 in comparison with Curve 1 shows the pronounced improvement with agitation. It is also significant to find that increasing (Curve 5) as well as decreasing (Curve 4) the solution concentration with agitation decreases the average rate, indicating an optimum concentration.

Greatly increasing the temperature of the etching bath (Curve 3) also results in a decreased rate, and in an observed formation of etching residues over the copper surface, together with a pitting of the surface. Fifteen to twenty minutes are generally adequate for etching patterns in one-ounce copper. The agitator consists of a shake table which has a two-inch excursion and is eccentrically driven by a motor at 56 rpm.

Electro-etching or deplating may be applied to hasten the removal of copper but cannot be used to carry the process to completion because the etching eventually detaches some of the areas to be removed from the circuit. The last traces of copper must in any case be removed by straight chemical etching. Electro-etching is five or ten times as fast as chemical etching and has less tendency to undercut the resist, making an attack upon the copper which is "V"-shaped when viewed in cross section rather than the "U" shape or inverted "V" shape cross section of attack experienced with chemical etching, according to some authorities. Some manufacturers of photographically etched products leave the residue permanently on the surface as a protective coating. If it is desired to remove this residue, a weak solution of ammonia is effective. If necessary this may be followed by abrasion with calcium carbonate to give a final brightening. In any case, there should be a rinsing wash in running water.

Work with stiff laminates has also been applied to etched circuits on flexible backing. As an example, these techniques have been applied to a highly competitive, large production item, namely an a.c.-d.c. five tube receiver.

Fig. 4 is an under-chassis view of a typical five tube a.c.-d.c. superheterodyne showing the familiar intricate pattern of point-to-point soldering. This set is in a highly competitive price bracket where the fact that "it costs as much to cut and solder in a wire as a resistor" is important. Typically also, this set has had its design intensively sifted and has gone through an assembly line shakedown for the maximum economy consistent with quality before consideration is given to printing techniques. This has the effect, of course, of requiring that revision of the design in terms of a printed circuit be compatible, at least in part, with existing design.

Fig. 5 is a picture of this set adapted to preformed connectives as the initial step in simplifying assembly. The wiring pattern is prefabricated by etching two-ounce copper foil supported on a flexible cloth backing. Holes punched at appropriate places in the layout are located over socket terminals, transformer lugs, etc., so that the circuit may be "buttoned" over these and the connections soldered without change in the original arrangement of the major components. Crossovers were eliminated, with a single exception, by using the resistors and capacitors for the required bridges. The displaced connections which previously were individually cut, stripped, and inserted are shown at the bottom of Fig. 5. The minor components are now in a fixed location to assist both installation and maintenance. Where attachment is necessary to component lugs out of the plane of the connective pattern, the cloth-backed copper has been slit to form tape-like conductors which are directed to the component.

In further evolution of this receiver into printed form, Fig. 1 shows the loop antenna also etched and integrated into the connective harness. The cloth backing does not extend into the loop, which is supported during processing solely by the impregnating lacquer film. This permits subsequent mounting of the coil on a low loss but inexpensive base for support without encountering problems of moisture absorption during the etching process. A photograph of the loop appears in Fig. 3. In this manner, antennas for broadcast frequencies have been achieved

(*Continued on page* 31)

WAVE GUIDE CALORIMETER

By
SAMUEL FREEDMAN

Electronics Division
Transport Products Corp.

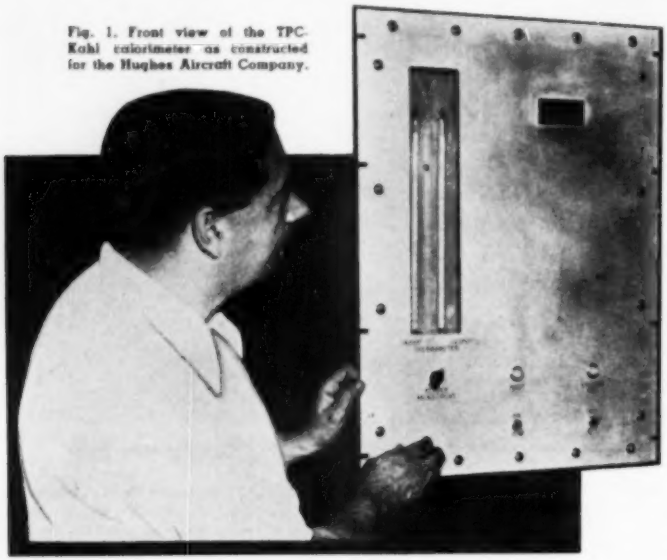


Fig. 1. Front view of the TPC-Kahl calorimeter as constructed for the Hughes Aircraft Company.

Accurate microwave power measurements, regardless of waveform or duty cycle, are possible with this unit.

THE MICROWAVE or wave guide type of calorimeter was introduced commercially in 1948 as a revolutionary method of measuring absolute or average power developed from a radar or magnetron output, and to serve as a primary standard in calibrating or checking any other apparatus used to measure microwave power directly or indirectly.

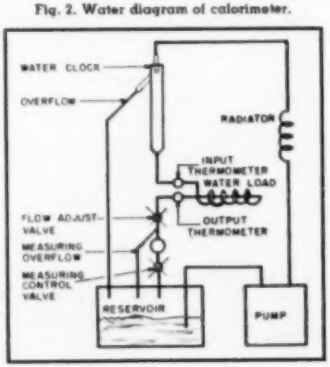
Physically, it is a device for circulating specific amounts of water through a glass water load in a wave guide, and for comparing the temperature difference between entering and returning water. The ability of water to absorb microwave power in a wave guide makes possible the direct or absolute measurement in actual watts of average power. This power is an average of whatever energy components are present, regardless of whether they are c.w. or pulsed. It is independent of the peak or fluctuating energy values existing in a system.

Absolute Power Measurement

In any radar or pulsed system, average power is still the final criterion of performance. The peak power, and the over-all capabilities of any radar, are tied in with average power. This power may be broken up into increments of a small number and of longer duration to provide low peak power, or many increments of short duration to provide high peak power. It is essential to have an accurate determination of average power, the foundation from which every other radar performance consideration has to be established. The microwave calorimeter is the most satisfactory device for the determination of average power.

Any commercial calorimeter includes

Fig. 2. Water diagram of calorimeter.



a water load of a very elaborate and super-sensitive type, as illustrated at the top of Fig. 6. This fits into a wave guide terminating section. Since it absorbs all the power terminating into that wave guide section, it is immaterial whether the section terminates as an open or closed wave guide. This unit is the heart of the calorimeter. Water circulates through its tubulation at a certain flow rate; for example, at 180 cc. per minute. The incoming energy is completely absorbed by the water in this load.

The simplest water loads, including all those used prior to the development of the model illustrated in Fig. 6, comprise no more than a tapered, double-compartmented glass section. Water enters through the outer compartment and returns at the tapered tip through the inner compartment.

The water load in the upper part of Fig. 6 is much more elaborate, having about 460 cm. of developed glass path between input and output thermometer points. It is designed to fill the wave guide and intersect every energy mode several times in the X and Y planes along the Z axis. All the power is absorbed in the form of increased water temperature within the first third of the water load, the remaining two-thirds offering complete assurance of power absorption.

As illustrated, the unit has several water load sections all connected in series. At the left end is a tapered section of 1 to 2 wavelengths long for the lowest frequency to be measured. This is double-compartmented. Water comes in through the outer compartment and is returned through the inner compartment. There are also two glass coils of 3 mm. glass tubing, side by side, and a third larger oval glass tubulation of larger diameter encompassing the two smaller glass coils. At the beginning and at the end of this lengthy glass tubulation system are thermometer wells for input and output thermometers. In the new calorimeter, small "Dewar flask" units make up the wells, with the thermometers fitting into the "Dewar flasks." This minimizes the tendency of thermometers to be affected by local temperatures other than that of the water. Small glass

extremities on the tip are for the purpose of balancing the water load in the wave guide.

Also illustrated in Fig. 6 is a single coil water load in which a vacuum exists between the coil section and the outer jacket so that the heated returning water will not be affected by the cold incoming water. Also, any infrared radiation from heated water will be jacketed by the outside colder water. The third item illustrated in Fig. 6 is a version of the Egyptian water clock type of flow meter. Water comes in at the top, fills the clock to the level of the overflow tube, and yields a steady pressure and flow through the free orifice at the bottom.

Any calorimeter must include a circulating system which produces a predetermined rate of flow through the water load. Provision must also be made to keep this flow constant during the time that measurements are to be made. A cooling system is provided to restore the water to room temperature before it is allowed to return to the water load for continuing power measurements.

Average Power

The heat transfer is equal to the weight of the circulating water multiplied by the temperature difference and multiplied also by the specific heat of the liquid which, in the case of water, is unity.

Since 1 cc. of water weighs 1 gram, the basic formulas for calorimetry may be reduced to the following simple relationship:

$$\text{cc. per min.} \times \text{temp. diff. (°C)} = \text{calories per min.}$$

Since 1 watt = 14.334 calories per minute, the average power can be accurately calculated.

From the foregoing, it may be seen that variations in water flow cause a wide range of temperature difference for a given power. Actually, a calorimeter is calibrated by selecting a flow which will cause a desired temperature difference for a certain amount of power. There are practical maximum and minimum temperature limits to be used.

If the outlet temperature is permitted to exceed about 65°C, air bubbles may form in the liquid. The minimum temperature is that of the highest temperature likely to exist in the working space, such as 25°C. There is a usable over-all range of about 40°C. For example, if the calorimeter is to measure from 0 to 500 watts average power, a flow rate should be selected which will produce a temperature rise of 0.08°C for each watt of power. If the instrument needs only measure up to 50 watts, then a flow rate can be selected to produce a temperature rise of 0.8°C for each watt of power to be measured.

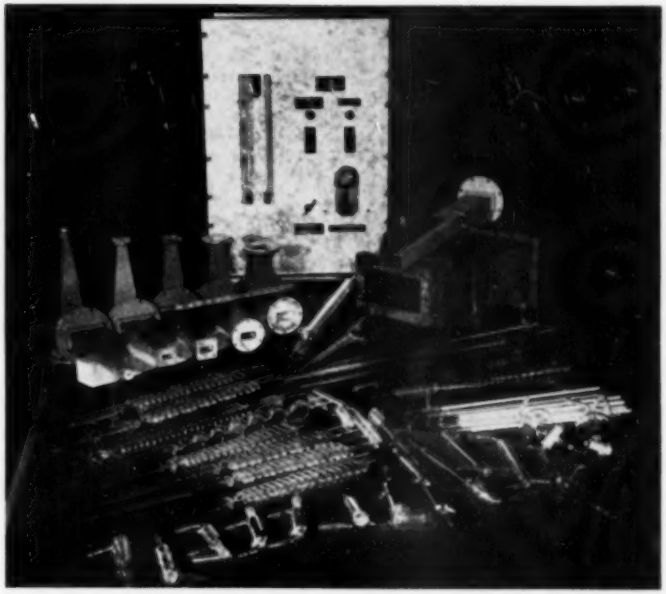
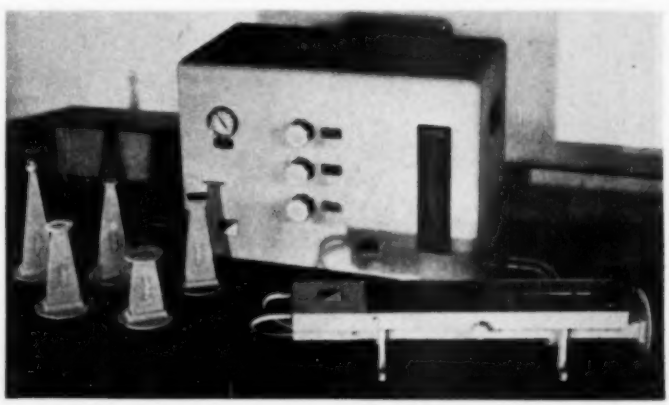


Fig. 3. Improved version of calorimeter in background, with various wave guide adapters and tubes immediately in front. In the foreground are many different types of water loads. The longer and narrower the load, the smaller the VSWR. At the left front are several silvered Dewar flasks for thermometers. At right front are several thermometers and three Egyptian water clock flow meters.

The first commercial calorimeters were developed at *DeMornay Budd Inc.*, as an offshoot of the company's wave guide program. That firm discontinued operations in August, 1949. During 1948 and the first half of 1949, a total of fourteen units such as the one illustrated in Fig. 4 were built.

These calorimeters comprised two separate units interconnected with rubber tubing. As shown in Fig. 4, the large cabinet contained the water reservoir, flow meter, water reservoir temperature and water control valves. The cooling system consisted of tap water entering one of the plumbing fittings shown at the left lower end of the cabinet and returning out of the other. The flow meter, calibrated in hundredths-of-a gallon flow per minute, is the glass column at the right. The actual calorimeter is the unit in the front of the illustration comprising a wave guide (S-band or 3" x 1½" size) containing a tapered water load plus two thermometers supplied with a slide rule

Fig. 4. A commercial microwave calorimeter, developed by DeMornay Budd, Inc.



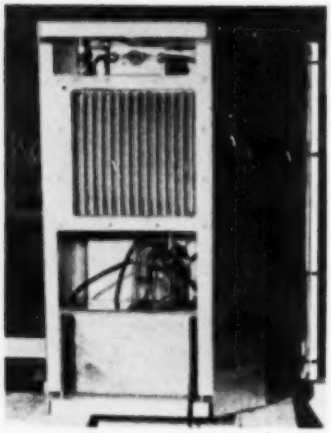


Fig. 5. Rear view of TPC-Kahl microwave calorimeter shown in Fig. 1.

scale. The reference point on the slide rule is set by a knob to the mercury level of the input (horizontal) thermometer. Then, in line with the mercury level of the output (horizontal) thermometer, the power is read directly in watts on the slide rule scale.

Also shown in the illustration are five wave guide transitions or adapters used to couple radar systems operating at higher frequencies. Although the mode of operation undergoes change by use of such a transition, the water load absorbs the energy of all the modes present in the calorimeter wave guide section. It will be noted that the length of the wave guide transitions increases with the magnitude of the transition to be made in terms of wavelength or frequency. They all have the same flare angle but their extension varies with the final dimension to be reached.

Although the *DeMornay Budd* calorimeter quickly became a useful instrument, superior to anything else previously available for measuring absolute power, it had certain design difficulties which were not fully overcome in succeeding designs of other firms. A survey of calorimeter users indicated the following design shortcomings:

1. There was a lack of portability and a tendency for errors to develop when the level, placement, and height of one unit were changed with respect to the other of the two-unit calorimeter apparatus.
2. The water load and thermometers underwent misalignment with respect to each other.
3. The slide rule scale developed errors when thermometers were changed or disturbed.
4. The units had a multiplicity of control valves.
5. The flow meter used a moving float which could stick or pick up sediment.
6. Air bubbles and sediment could develop in the system.
7. The water load did not completely intersect all the possible energy modes likely to exist in the X and Y planes along the Z axis within the wave guide section.

Improved Calorimeter

Fig. 2 shows the water circuit diagram of an improved calorimeter developed by *Technical Products and Services Company*, of Santee, Calif., operating as the Electronics Division of *Transport Products Corporation*, of Louisville, Ky. It utilizes new, improved glass techniques brought to the United States by German glass experts employed by the *Kahl Scientific Instrument Corporation*. The water load, illustrated in Fig. 6 and improved in later models, is designed to provide the maximum exposure of glass tubulation to r.f. energy, with the least feasible amount of water needed to fill the water load. It is designed to permit a water flow up to 300 cc. per minute when flowing by gravity alone.

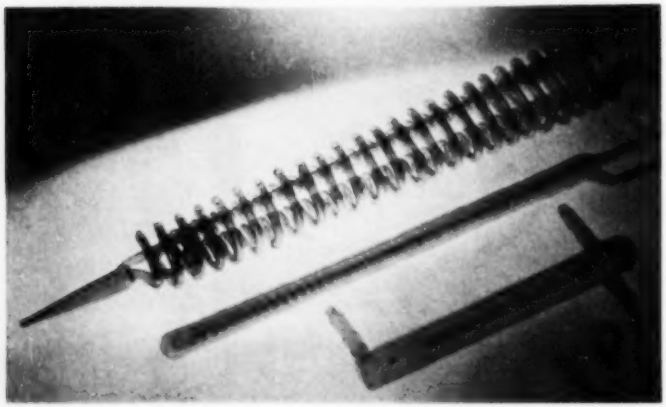
Constancy of the water flow must be maintained. This is accomplished by using an Egyptian water clock, previously described. The flow rate is adjusted by means of a flow adjustment valve and is maintained constant by means of the water clock device. Any small variation in the delivery of the circulating pump changes the amount of overflow but not the volume of water in the tube.

The circulatory system consists of a vibratory pump, radiator, blower motor and a stainless steel water reservoir. The pump operates on the jet principle, vibrating about 7200 times per minute. It requires little power and can be varied in output pumping rate by changing the input voltage. The radiator and circulating fan restore the water to room temperature before the flow is reintroduced to the wave guide water load. Short periods of use may not require the temperature-restorer cooling system, particularly for lower power measurements (below 50 watts average power), as it would take many circulations through the system before reservoir water would rise appreciably in temperature.

Although standard reference water has been used in study and experimentation, in practice any clean tap water suitable for drinking has been found satisfactory. The presence of impurities in water can cause it to have a higher specific heat, resulting in some positive error. Even distilled water, if used for a long time, will lead to the development of impurities in the system. Experiences to date with calorimeters used in areas such as Fort Wayne, Ind., Long Island, N. Y., and San Diego, Calif., have been satisfactory with clean drinking water.

Fig. 1 shows the entire calorimeter in a cabinet. The only controls on the front panel are the toggle switches for the pump and the radiator blower motor. Recessed behind the panel are two thermometers, specially built with expanded scales and with the mercury column color-coded by means of capillary, glass-colored reflectors adjacent to the column. One thermometer shows a thick mercury line of blue; the other is colored red. This, plus the fact that the thermometers are vertical at eye level, makes them easy to read. The bases of these thermometers recess in miniature thermos-bottle, double-compartmented units, with water circulat-

Fig. 6. Top, super-sensitive water load. Center, simple water load with vacuum section between coil and outer compartment. Bottom, Egyptian water clock.



(*Continued on page* 29)

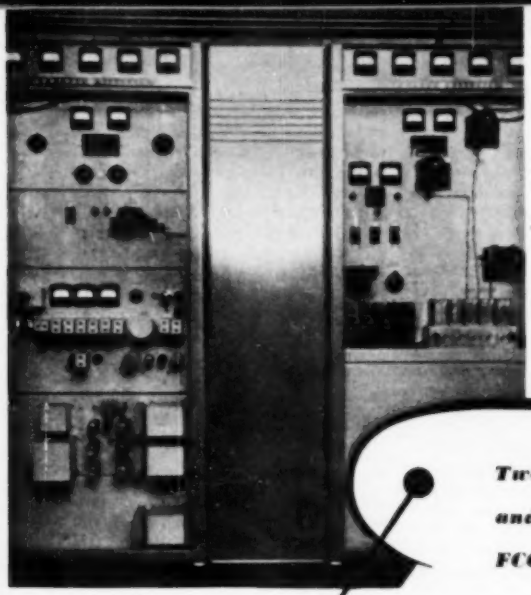


Fig. 1. Front view of the G-E transmitter equipped for remote control at WHYN.

Remote Control for FM Broadcasting

Two pairs of telephone line for metering and for control are necessary with this FCC-approved transmitter control system.

By

HAROLD SCHUMACHER

and

CHARLES TAMM

Engineering Staff, WHYN

WITHIN THE past year or so, a number of FM stations have returned either their construction permits or licenses to the FCC and have left the air. There have been various reasons given for these deletions but the most prevalent is that of economy. In many instances, remote control of the transmitter will prove to be an economical feature. Described below is a complete remote control system which is in experimental operation at this time by authority of the FCC.

There are, of course, other possible methods which may be used but the following seems to be most foolproof in operation.

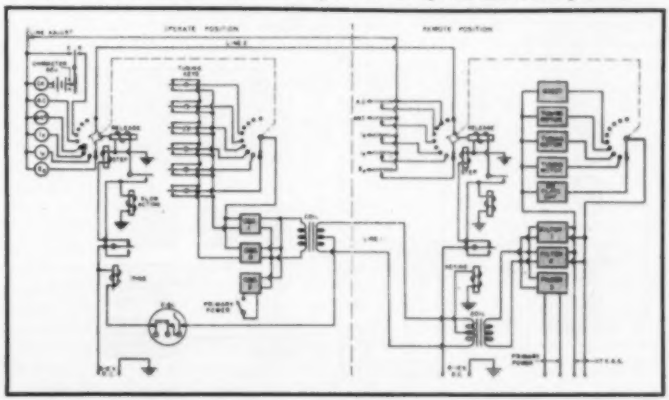
In the remote controlling of any transmitter, all FCC regulations and requirements pertaining to that type of service must be met by the remote control device so that the operator at the control point has complete control over the transmitter at all times while on the air.

In the case of FM broadcasting service, the following information must be available: final amplifier plate voltage and current readings, antenna transmission line r.f. output, center frequency deviation, percentage of modulation, and tower light operation, as well as continuous audio monitoring for quality control. It must be possible to control the final amplifier plate tuning and the antenna coupling load. In addition to the above requirements, it is possible, with this particular installation, to read final amplifier grid current, final screen voltage (and regulate same), tune the final grid circuit, adjust primary voltages, tune the antenna coupling load, turn on and off primary voltages (filaments, control circuits and blowers), and apply plate voltages.

The transmitter which is being used in this installation is a *General Electric* Type BF2A 3KW. The conversion can be accomplished without defacing the transmitter, as can be seen in Fig. 1. The control motors are mounted on angle brackets which, in turn, are mounted on the transmitter by means of the original dial panel mounting holes.

In this particular case, the remote control point is approximately six miles from the mountain top location of the FM transmitter. There are two pairs of telephone line required in addition to the regular program lines, one pair as metering line, and the other pair as control line. Provisions are incorporated at the control end for adjusting these lines daily to compensate for weather and resistive changes. At the remote end, each line is terminated through a ten-position stepping relay, the actuation of which is accomplished by a similar stepper and dialing system at the control point. In this way, it is only necessary to dial a single digit in order to perform any of the tuning operations and simultaneously receive the associated meter reading at the control panel. In the event of line failure,

Fig. 2. Basic circuit of remote control system for the operate and remote positions.



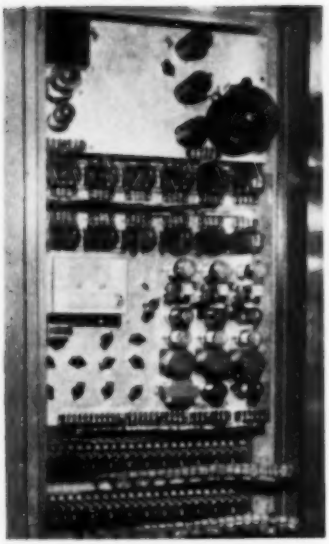


Fig. 3. Relay chassis and power supply at the transmitter location.

the transmitter is immediately thrown off the air, thereby assuring that the transmitter cannot continue on the air when it is out of control of the remote operator.

By referring to Fig. 4, a block diagram of the entire installation, and Fig. 2, a basic schematic diagram, it will be possible to trace the following operations.

At the remote transmitter location, time clock *A* applies primary control voltage to the remote relay chassis and its associated power supply one hour before air time. This power supply furnishes both six and twelve volts for relay operation as well as plate and filament voltages for the sharp bandpass tone amplifiers. There are three of these sharp bandpass amplifiers, one for primary transmitter power control, one for right hand tuning and one for left hand tuning. These tones are designated as primary, right, and left tone, respectively. They are in the audio frequency range and so chosen as not to be harmonically related. These tones actuate their respective sensitive plate relays in the tone amplifiers which, in turn, further actuate other relays, causing a right or left rotation of the tuning motors. These tuning motors operate at ¾ rpm and have been found to be satisfactory for delicate tuning.

After the time clock has turned on the relay chassis and its equipment at the remote point, the operator at the control point turns on the power to the control panel. When this equipment has warmed up, the primary power tone is applied to the control line. This tone, after passing through its bandpass amplifier, actuates proper relays which, in turn, apply primary power (filaments, blowers and starter circuit voltages) to the transmitter. This primary tone is constantly on the line during the time the transmitter is in operation. In the event of line failure or termination of this tone, the entire system collapses and the transmitter goes off the air.

After the above primary power is applied to the transmitter, the operator may dial #1 at the control point. Meter #1 on the control panel will give the primary voltage reading, and by actuating the anti-capacity type toggle switch below meter #1, the Variac controlling the transmitter line voltage can be adjusted.

Dialing #2 and throwing the toggle switch under meter #2 to the right will apply plate voltage to both the driver and final amplifier stages. Meter #2 will then read the final amplifier plate voltage. By throwing this same toggle to the left, the plate voltages will be removed, but the filaments and blowers will remain in operation until the primary tone is removed from the line.

Dialing #3 will allow meter #3 on the control panel to read total cathode current of the final amplifier, while by throwing the associated toggle, the plate tank capacitor will be tuned right or left to resonance.

Dialing #4 will again give total cathode current of the final amplifier and by throwing its associated toggle right or left, the antenna coupling may be varied.

Dialing #5 will give a reading of the relative antenna transmission line voltage, while operation of the toggle will control the Variac in the screen grid circuit. (Also note dialing #7.)

Dialing #6 will give the grid current of the final amplifier, and its toggle will tune the grid capacitor.

Dialing #7 will give the screen grid voltage, while throwing its toggle will also control the screen Variac, as in position #5.

Dialing #8 will short the metering line to ground at the remote end to enable the control operator to zero-adjust the line, thus compensating for day to day changes.

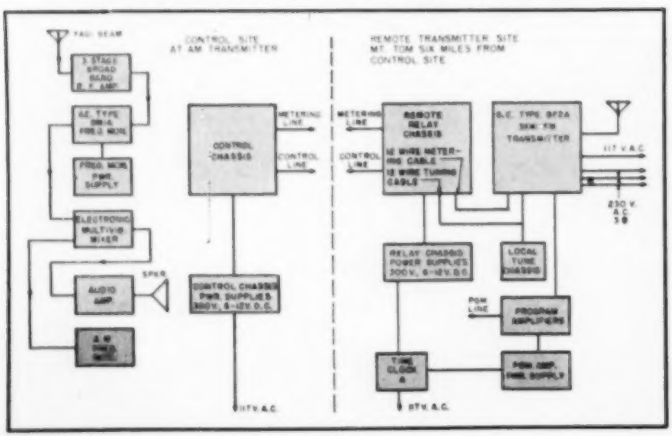
Dialing #9 will, by use of the toggle, allow the audio gain of the program amplifier at the remote location to be regulated. The metering at this position is, at present, unused, audio gain being apparent by percentage of modulation on the frequency meter.

Dialing #10 will give an actual meter reading of the operation of all tower lights as well as the top flashing beacon. The toggle at this position is to be used for turning on and off the antenna de-icing equipment. A note of interest is the method of constant observation of tower light operation. The tower lighting consists of two pairs of 100-watt lamps at respective levels and a twin 500-watt flashing beacon. A sampling voltage is taken off a current-operated transformer, rectified and sent down the metering line when #10 is dialed. With just the four lamps burning on the tower, a given voltage is registered on the meter, and each time the top beacon flashes, this reading increases. It is, therefore, possible to determine if any of the four small lights have gone out or if the beacon is not functioning properly.

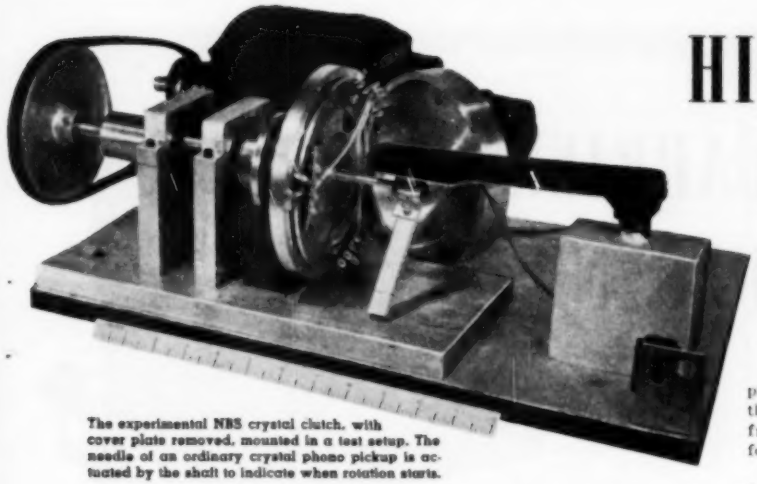
At the remote transmitter location, the equipment consists of the remote relay chassis and its associated power supply, seen in Fig. 3. The relay chas-

(*Continued on page 27*)

Fig. 4. Block diagram of equipment at control site and remote transmitter.



HIGH SPEED CRYSTAL CLUTCH



The experimental NBS crystal clutch, with cover plate removed, mounted in a test setup. The needle of an ordinary crystal phono pickup is actuated by the shaft to indicate when rotation starts.

Response speed of 0.2 millisecond is achieved by applying a voltage to suitable Bimorph crystals.

AN EXPERIMENTAL crystal clutch recently developed at the National Bureau of Standards is believed to be the first of its type. In the new clutch, application of a direct-current voltage to the electrodes of three "Bimorph" piezoelectric crystal elements causes bending of the elements. This bending presses the clutch output disk against the rotating input disk. The new experimental unit was devised by Ernest Cedier of the NBS staff as part of a program for the development of fast-acting clutches suitable for use in high speed computers.

Distinguishing features of the crystal clutch are high speed of response and almost negligible current drain. No current flows, other than insulation leakage, after the applied voltage has charged the capacity of the crystals. The clutch therefore creates no magnetic field, an advantage in some applications.

In the only clutch model thus far constructed, the output shaft delivered useful torque in as little as 0.2 millisecond after voltage was applied. Output torque of the engaged clutch was approximately 16.5 ounce-inches at 400 volts excitation, or 21 ounce-inches for 500 volts. The no-voltage drag torque, however, was about 7.5 ounce-inches, a substantial fraction of the engaged torque.

Construction of the crystal clutch is essentially simple. The output disk is located between two rotating members: a thin, flexible crystal pressure plate and a heavier mounting plate or input disk. Three of the Bimorph crystal elements, which bend when opposite potentials are applied to different parts of the crystal surfaces, are spaced at 120-degree intervals. When the exciting voltage is applied, the crystals press against the pressure plate at a radius of 1.5 inches, pinching the output disk between the pressure plate and the input disk.

The clutch proper and its immediate mounting occupy a space about six inches in diameter and a little more than an inch long. The complete assembly includes, in addition, internal bearings for the output shaft, bearings and mounts for the entire assembly, a drive pulley, and slip rings for transmitting the exciting voltage to the rotating assembly.

The new clutch was tested for speed of response by placing the needle of an ordinary crystal phonograph pickup in a small dimple in the clutch output shaft. By connecting the pickup output to the vertical input of a cathode-ray oscilloscope, and connecting the clutch excitation voltage to the horizontal input, the time lag between the application of the exciting voltage and the resulting motion of the output shaft was observed. Alternatively, by connecting the Bimorph terminals to the vertical plates of the oscilloscope, it was possible to observe the voltage rise as the capacitance of the Bimorph crystals became charged.

Several factors enter into the design of a clutch of this type. Speed of response, the principal design goal, is related to the inertia and loading of the output system, the available torque, the distance the crystal pressure point must move before it begins to pinch the output disk, and the resonant frequency of the crystal itself. It is the resonant frequency that sets the ultimate limit for speed of response.

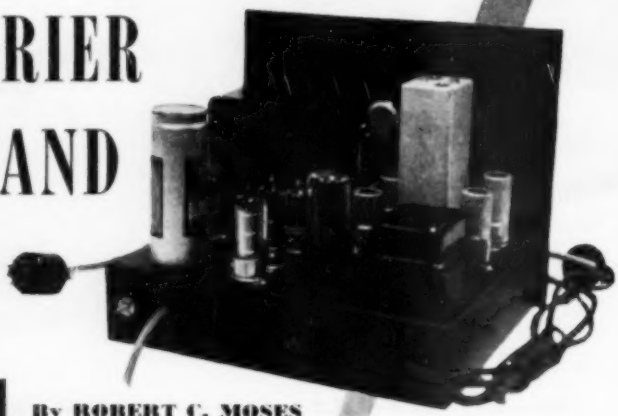
The dimensions of the Bimorph crystal determine not only its resonant frequency but also its sensitivity. The resonant frequency, in kilocycles, of a Rochelle-salt crystal Bimorph is given by $26\ T/LW$, and the sensitivity in mils per kilovolt is approximately $0.08\ LW/T^2$, where L, W, and T are crystal length, width, and thickness, in inches. Since increased crystal thickness is favorable to high resonant frequency but unfavorable to high sensitivity, design dimensions must be matters of compromise and judgment.

If resistance is present in the excitation circuit, the voltage appearing across the crystals will rise exponentially while the crystal capacity (about 0.0065 μfd.) is charged. If the voltage rise is excessively slow, speed of response will of course be impaired. It might be thought that if resistance were eliminated, so as to give very fast voltage rise, speed of response would be a maximum. This does not prove to be the case, however. Instead, an irregular output motion appears, while response time shows no significant improvement.

Rochelle-salt crystal elements are used in the present clutch because they are readily available and highly sensitive. Rochelle salt has several disadvantages, however: it is easily fractured, melts at 55°C, and will deliquesce unless protected from humidity. Barium titanate crystals, a logical alternative, should provide a mechanically rugged clutch usable at temperatures up to 100° C.

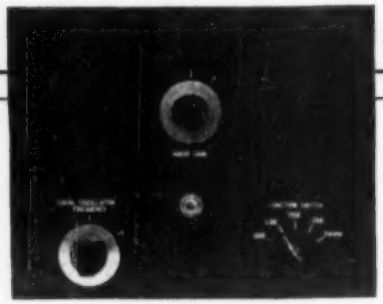
Obviously, the crystal clutch developed at NBS does not have wide applicability. Yet its high speed and negligible current drain could be very valuable in a few highly specialized but nevertheless important instrumentation functions. The experimental clutch model could undoubtedly be improved upon; in fact, several desirable modifications have already become apparent.

EXALTED-CARRIER SINGLE-SIDEBAND RECEPTION



Top-rear view of adapter removed from the cabinet.

By ROBERT C. MOSES



Front panel view of the converter, showing the various controls which are used.

Theory of operation and fundamental circuit design of an adapter for exalted-carrier SSSC reception.

SINGLE-SIDEBAND suppressed carrier (SSSC) offers advantages over certain other methods of transmission, particularly in point-to-point radiophone systems where readability under adverse conditions is of primary importance. Among these advantages are reduced bandwidth requirements, elimination of heterodyning resulting from co-channel interference, improved over-all signal-to-noise ratio, and substantially higher operating efficiency. Reception of SSSC does, however, impose certain special requirements upon the communications receiver if the above advantages are to be fully realized. It has been found that these requirements are effectively fulfilled with an adapter unit of the type to be described in this article. Making use of synchronous detection with exalted-carrier reception, this unit provides additional functions necessary for reception of SSSC transmissions. Also, selection of either or both sidebands of a conventional AM signal, as well as detection of FM and PM, is made available.

The principle of exalted-carrier reception with phase rotation of the demodulated audio components to select either sideband independently is not new. Work along these lines was carried on as far back as 1945 by M. G. Crosby and others[1], and more recently by D. E. Norgaard of *General Electric Company*.[2] The unit to be described is patterned in part after Mr. Norgaard's original design, but incorporates certain features which make for an over-all simplification of the receiving system.

Demodulation of signals in which the carrier and one sideband are partially or completely suppressed involves, in addition to the usual r.f. and i.f. amplification, the following provisions in the receiver:

1. Generation and insertion of a synthetic local carrier of the proper frequency and phase to permit substantially distortionless demodulation of the single-sideband suppressed-carrier signal.
2. Combination of separate audio components corresponding to the desired and any residual undesired sideband components in such a manner that the latter are discriminated against.
3. Means of selecting either the upper or lower sideband signals for further amplification.
4. If the receiver is intended to respond also to double-sideband plus carrier transmissions, suitable means of maintaining phase synchronism between the received carrier and the locally generated carrier must be provided.

The above requirements are fulfilled in the dual exalted-carrier demodulation system to be described.

Theory of Operation

Single frequency sine wave modulation on a single-sideband suppressed-carrier signal produces a pure r.f. component of frequency, corresponding to that of the original carrier plus or minus the modulation frequency, and an amplitude proportional to that of the modulating signal. Thus, if a 50-volt, 4000-kc. carrier were amplitude modulated by a 5-volt, 1000-cycle sine tone, and the carrier and upper sideband were subsequently eliminated, the result would be a single radio frequency signal at 3999 kc. having an amplitude of approximately 5 volts. If the modulating signal were a complex speech waveform occupying a band of frequencies from 100 cycles to 3000 cycles, the resulting single-sideband output would be a band of r.f. components ranging from 3999.9 kc. to 3997.0 kc. The spectrum of such a single-sideband suppressed-carrier signal would occupy the band of fre-

quencies from 3997.0 kc. to 3999.9 kc., with no components present above 4000 kc.

In order to recover intelligence from an SSSC transmission in a substantially distortionless manner, it is necessary to demodulate the received single sideband against a locally generated carrier having a frequency exactly the same as that of the original carrier.[3] This is essential in order that the demodulation audio components lie in the correct frequency relationship both to the original carrier and to each other. By the same token, the amplitude of the locally generated carrier should be very much greater than the peak amplitude of the received signal, in order to insure minimum distortion in the demodulation process.

Dual Exalted-Carrier Demodulation

If a locally generated carrier of 150 volts peak amplitude, at a frequency of 4000 kc., was combined with a two-volt signal at 3999 kc. in a suitable demodulator, the resulting audio output would be a 1000-cycle signal having an amplitude of about two volts. If this same 3999-kc. signal were introduced simultaneously into two similar demodulators, and the 150-volt local carrier applied to one of them were shifted in phase by 90° with respect to the carrier applied to the other, the audio output from each demodulator would still be a two-volt signal at 1000 cycles. The two audio voltages would, however, be in phase quadrature, and this relationship would hold regardless of the r.f. frequency of the two-volt signal. The important aspect of this otherwise commonplace effect is that the phase relationship between the two audio voltages reverses if the two-volt r.f. signal producing the 1000-cycle beat lies on the opposite side of the local oscillator frequency. For example, if a +90° phase difference between the audio voltages exists when the two-volt r.f. signal is at 3999 kc., then a −90° phase relation would result if the frequency of the latter were shifted to 4001 kc. The phase relationship between the demodulator output voltages thus gives an indication of whether the r.f. signal is on the high or low frequency side of the local oscillator.

In practical demodulation of an r.f. carrier having sideband components above and below the local oscillator frequency simultaneously, a double-sideband AM signal, for example, these effects occur separately and independently in each demodulator. Thus, the individual sideband components of the double-sideband signal are resolved into discrete groups of +90° and −90° voltages of equal amplitude and identical waveform. If the individual demodulator outputs are fed to a pair of audio-phasing networks having the property of introducing constant +45° and −45° differential phase shifts over the useful audio frequency range, the resulting output voltages will be in-phase for one set of sideband components, and 180° out-of-phase for the other. Suitable means may be employed for combining these voltages differentially, thus discriminating against one or the other of the two sidebands.

A block diagram of such a dual exalted-carrier demodulation system is shown in Fig. 2, while Fig. 1 illustrates the phase relationships existing at the several significant points.

Selection of Sideband

By reference to the vector diagrams, it can be seen that the direction in which the phase of the 90° audio voltage at the output of each demodulator is rotated will determine which one of the two sideband components will appear at the output of the combining amplifier. In order, then, to select either the upper or lower sideband independently, it is only necessary to interchange the positions of the 45° lead-lag networks with a suitable reversing switch. It is possible also to pass both sideband components of a double-sideband signal by simply disconnecting one of the demodulator outputs from the audio-phasing network. In addition, amplitude demodulation of an FM or PM signal may be accomplished by combining its sidebands with a local carrier shifted 90° in phase with respect to the carrier of the received signal. Since the required r.f. phase shift is already provided, it is only necessary to bridge around the audio-phasing network, and connect the appropriate demodulator directly to the combining amplifier.

Synchronizing of Local Oscillator

The output voltage of either demodulator in the presence of a small unmodulated carrier is determined by the strength of the small carrier and its phase relationship to the local oscillator signal at any particular instant. The absolute value of this voltage is proportional to ($E_c \cos \theta$), where E_c is the peak carrier

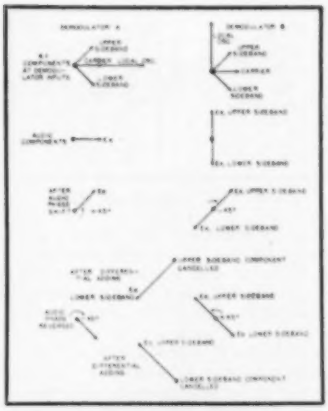


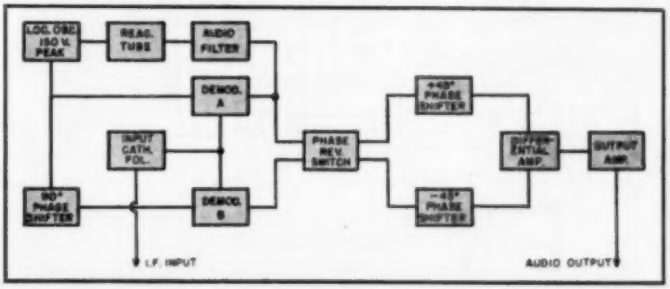
Fig. 1. Phase relationships in adapter.

voltage and θ is the phase angle between the two r.f. signals. The local oscillator is applied to each demodulator in quadrature; therefore, when the two r.f. signals are in phase synchronism, the d.c. output of one demodulator will be essentially zero while the output of the other will be a d.c. voltage approximating the peak of the applied carrier. Use is made of one of these d.c. components for local oscillator phase control by applying it to a reactance tube connected across the tank circuit of the latter. The local oscillator is thus caused to lock into synchronism with a receiver carrier, and the sidebands of the received signal are demodulated against a large synthetic carrier acting in place of the real carrier.

Circuit Details

Fig. 4 shows a complete schematic diagram of the dual exalted-carrier demodulator and its associated audio circuits. Because the adapter unit is intended to operate out of a communications receiver having an i.f. on the order of 465 kc., the operations outlined above are carried out at this frequency. The local oscillator V_3 uses a small power pentode, type 6AK6, in an electron-coupled circuit with a high in-

Fig. 2. Functional block diagram of the complete adapter unit.



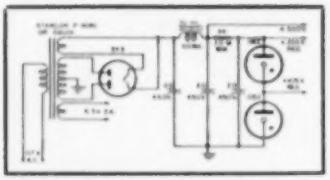


Fig. 3. Circuit of the power supply.

ductance grid tank. The tuning capacitance for the oscillator is supplied in part by a small trimmer capacitor, C_{3a}, in parallel with a panel vernier control, and in part by the equivalent capacitive reactance of the oscillator control tube V_4, a type 6BH6. The plate of the oscillator is capacitively coupled to one of the demodulators, and inductively coupled to the other by means of the double-tuned i.f. transformer T_1. This i.f. transformer provides the required 90° r.f. phase shift between the two local oscillator components which are applied to the demodulators. The coupling between the transformer windings is variable to permit equalizing of the amplitudes of these components.

Because the demodulators are somewhat unorthodox, they may deserve some special consideration. Fig. 5 shows a functional schematic of one demodulator, in which generators E_1 and E_2 represent the local oscillator and signal voltages respectively, and D_1 and D_2 are the demodulator diodes. R_1 and R_2 are the diode load resistors, capacitor C_1 is the diode load capacitor, and R_3, C_2 are the usual r.f. filter elements. For purposes of explanation, it will be assumed that the diodes have matched characteristics, and that the resistors R_1 and R_2 are equal in value.

Consider for the moment that no signal voltage is applied at E_2, and that E_1 is a 150 volt peak signal at the i.f. frequency. Consider also that the equivalent impedance of generator E_2 is negligible compared to that of E_1 and the load resistors, R_1 and R_2. Voltage E_1 is applied to diode D_1 through capacitor C_1 and generator E_2. E_1 is also applied to diode D_2 through capacitors C_1 and C_2. At the instant when E_1 is positive at the anodes of the diodes, a rectified current, I_{d1}, flows through D_1, generator E_2, and load resistor R_1 in such a direction as to make the common anode connection of the diodes negative by approximately the peak of voltage E_1. At the same time, an equal current, I_{d2}, is flowing through diode D_2 and resistor R_2 so that the cathode end of R_2 becomes positive by the same amount. The cathode of D_2 and the output terminal are, therefore, at the same potential as the ground end of R_2. Consequently, the circuit as a whole is balanced for any value of E_1.

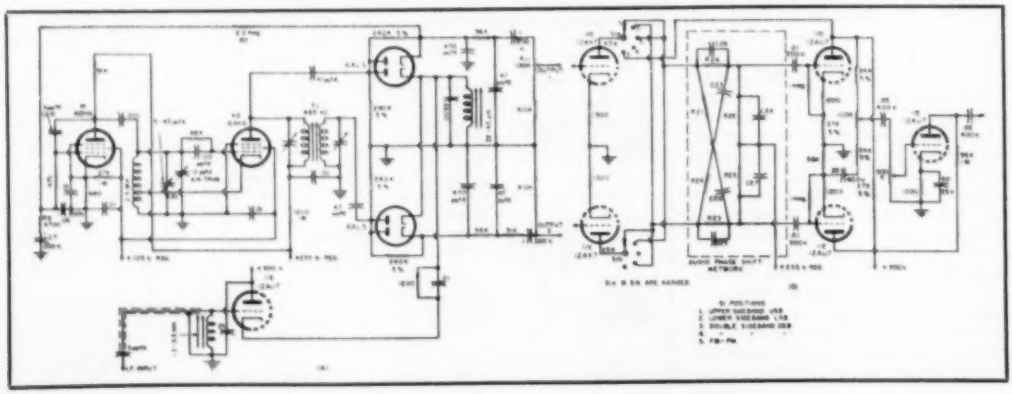
Now let a small voltage be applied at E_2, and assume for the moment that E_1 and E_2 are of the same frequency and phase. Because E_2 is impressed only across diode D_1, this diode is acted upon by the voltage $E_1 + E_2$, and therefore will produce a proportionally greater current through its load resistor R_1. The circuit is unbalanced by this small voltage, the cathode of D_1 becoming negative by an amount approximately equal to the peak value of E_2. If, on the other hand, the two voltages are 180° out-of-phase, diode D_1 will be subjected to the effective voltage $E_1 - E_2$, and the circuit will become unbalanced in the opposite direction. The cathode of D_2 will go positive, again by an amount equal to the peak value of the small voltage E_2. It can also be shown that if the relative phases of E_1 and E_2 lie between zero and 180°, the cathode potential of D_2 will vary between $-E_2$ peak and $+E_2$ peak, and will become zero when the phase relationship between the two voltages is 90°. The demodulator is thus phase- as well as amplitude-sensitive, and the output voltage at any instant is proportional to the peak value of E_2 multiplied by the cosine of the phase angle between the applied r.f. voltages E_1 and E_2.

Like any conventional diode detector, the output of each demodulator contains a d.c. component. However, in this case, the d.c. component is fundamentally phase-sensitive as mentioned above. The d.c. component at the output of one demodulator is filtered by means of the resistance-capacitance elements $R_1 - C_4$ and $R_2 - C_3$ (Fig. 4), and applied to the grid of V_4 as a control voltage for local oscillator phase correction. The control circuit is associated with the demodulators in such a way that the phase of the local oscillator signal is inherently 90° displaced from that of the received carrier when the frequencies of the two are synchronized. This latter point is important inasmuch as it determines the relative phasing of the locally generated carrier and the sidebands of the received signal when FM and PM transmissions are demodulated by the phase rotation method.

The audio components at the output of each demodulator are in quadrature, having undergone a ±90° phase displacement during the demodulation process. These audio components are amplified individually in the two sections of a 12AX7 dual high-mu triode, V_5. One side of the amplifier incorporates an audio gain control, R_{11}, to facilitate equalizing of the output voltages. Because it is essential that the audio components retain their original 90° phase relationship up to and including the plate circuits of V_5, each half of the stage operates with negative feedback developed across individual unbypassed cathode resistors. This feedback improves the phase response of the amplifier, and minimizes the generation of spurious harmonic components which would impair the sideband discrimination properties of the system.

The audio phase shift networks are

Fig. 4. (A) Schematic diagram of the dual exalted-carrier demodulator i.f. circuit. (B) Audio circuit.



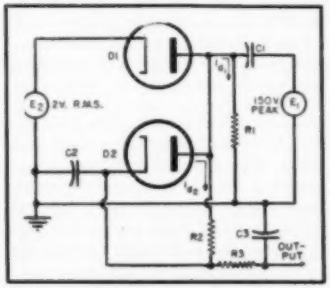
Audio Phase Shift Network	
Part No.	*Required Value*
C_{11}	6300 $\mu\mu$fd.
C_{12}	2100 $\mu\mu$fd.
C_{13}	4750 $\mu\mu$fd.
C_{14}	28500 $\mu\mu$fd.
C_{15}	9500 $\mu\mu$fd.
C_{16}	1050 $\mu\mu$fd.
R_{11}, R_{14}	15,000 ohms
R_{12}, R_{13}	50,000 ohms
R_{15}, R_{16}	100,000 ohms

Table 1. Components for the audio phase shift network of Fig. 4B.

complementary 45° lead-lag circuits which provide a constant 90° differential phase shift over a band of frequencies from 200 to 2600 cycles. These networks have a lattice configuration employing six resistive and six capacitive elements, and introduce an insertion loss of approximately 9½ db at 1000 cps. The design of such phase-shifting circuits has been discussed in detail elsewhere.[4,5] In this particular arrangement, two input voltages having a quadrature phase relationship will provide two output voltages having either a 0° or 180° phase difference. The output phase relationship depends upon whether the input components were initially shifted by +90° or −90°. Because the direction of phase rotation will determine which of the two sideband components are rejected in the following circuits, selection of sideband sense is accomplished by interchanging the positions of the 45° lead and 45° lag circuits with respect to the demodulator outputs. The in-phase and out-of-phase audio voltages corresponding to the two demodulated sideband components are applied to a differential combining amplifier designed to respond to 180° phased signals and reject in-phase signals.

The combining amplifier, V_{9}, a dual triode type 12AU7, is made up of two individual parallel channels, each of which is 100% degenerative. One chan-

Fig. 5. Equivalent circuit of balanced demodulator. D_1 and D_2 are matched, and $R_1 = R_2$. E_1 represents local oscillator signal; E_2 represents I.I. signal.



* MAGNECORDER

Sound Performance



(Photo by A. Alberts, 1950)

. . from "Studio A". . . to TIMBUKTU! *



The famed traveler, Art Alberts, recently used Magnecord Tape Recorders in his search for African tribal music — never before recorded. His Magnecorders underwent 140 degrees temperature, relative humidity ranging from 8 to 99, and 5,000 miles of grueling, jouncing desert and jungle trails. Operating perfectly all the way, Magnecorders brought home faithfully accurate reproductions from the court of the Mossi Emperor, south of Timbuktu.

Whether in Timbuktu or in Studio A at KRSC, Seattle, Wash., Magnecorders handle delayed programs and "on location" recordings with constant dependability. Easy portability, precision and fidelity make Magnecorder the first choice of radio engineers everywhere.

MORE FEATURES
PT7 accommodates 10½" reels and offers 3 heads, positive timing and pushbutton control. PT7 shown in console is available for portable or rack mount.

GREATER FLEXIBILITY
In rack or console, or in its really portable cases, the Magnecorder will suit every purpose. PT6 is available with 3 speeds (3¾", 7½", 15") if preferred.

HIGHER FIDELITY
Lifelike tone quality, low distortion, meet N.A.B. standards — and at a moderate price. PT63 shown in rack mount offers 3 heads to erase, record and play back to monitor from the tape while recording.



WRITE FOR NEW CATALOG

Magnecord, INC.

360 North Michigan Avenue
Chicago 1, Illinois, Dept. RE-3

Send me latest catalog of Magnecord equipment.

Name.....

Address.....

City.....Zone.....State.....

CONSERVE VITAL MATERIALS

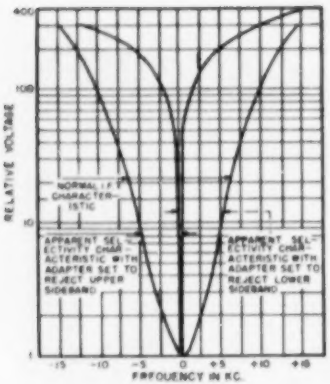


Fig. 6. Normal selectivity curve and apparent selectivity with adapter set to reject upper and lower sidebands.

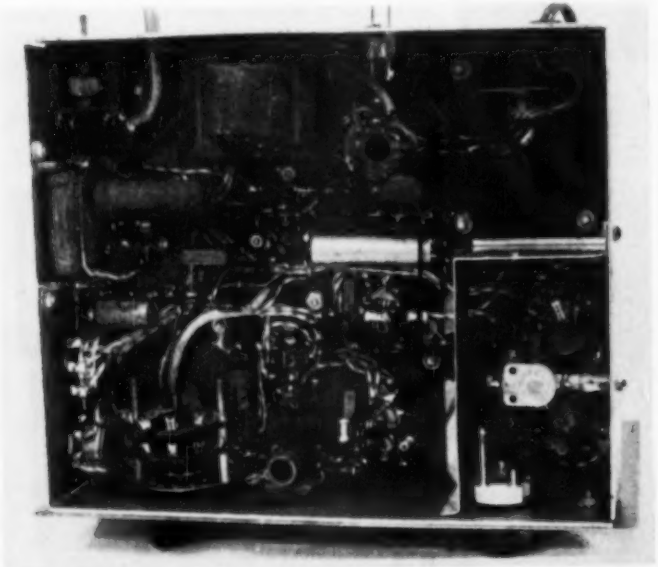
nel consists of a cathode follower with a relatively large cathode load resistor, while the other includes both plate and cathode loads, the values of which are equal. The plate signal from the latter channel is combined with the cathode signal from the former across a potentiometer, R_m, which serves as a balancing control. In practice, this potentiometer is adjusted for maximum suppression of the undesired sideband. A combined output signal, proportional to the sum of the two 180° phased input voltages, appears at the center of R_m, while in-phase components across it are effectively cancelled. The resulting single-ended voltage is then amplified in a conventional output stage consisting of one section of a 12AU7, V_{7a}.

Because the equivalent impedance of the source supplying the i.f. signal to the demodulators must be negligible compared with the diode load resistances and the impedance of the local oscillator source, the demodulators are driven from a cathode follower. This consists of the other triode section of V_7, the cathode load for which is the low-impedance L-C circuit, L_c-C_m, tuned to the i.f. frequency. Coupling from the receiver is effected through a four-foot length of RG71/U coaxial cable. The capacitance of this cable (54 $\mu\mu$fd.) is of the correct value to resonate the grid circuit of the input cathode follower to the i.f. frequency. The i.f. signal is extracted from the receiver through a very small coupling capacitor, C_m, at the plate of the last i.f. amplifier stage. The over-all voltage transfer from the last i.f. amplifier to the demodulators provides a gain of about three, due to the moderately high Q of the tuned input circuit. The optimum operating level at the grid of the cathode follower is approximately two to four volts r.m.s., although effective local oscillator synchronization is obtained at levels as low as 0.5 volts. Use of the receiver a.v.c. has been found to be neither desirable nor necessary.

The five-position function switch, S_1, permits reception of the upper or lower sideband independently, both sidebands together, or FM-PM signals. In each of the two double-sideband positions, one or the other of the demodulator outputs is disconnected from the audio phase shift networks. In the FM-PM position, the sidebands of the received signal are combined with a large local oscillator voltage, shifted in phase by 90°, and the appropriate demodulator output connected directly to the grid of the output amplifier. Under these conditions, the audio-phasing networks and the combining amplifier stage are unused.

The power supply is included as an integral part of the adapter, since the requirements of the unit are quite modest. The total plate supply drain is on the order of 38 ma. at 300 volts, and the heaters require 6.3 volts at 1.8 amperes. To insure stability of the local oscillator under variable line voltage conditions, the plate and screen supplies of both the local oscillator and reactance tubes are regulated by means of miniature VR tubes. These have the further purpose of reducing the effective impedance of the plate supply to the first audio amplifier, V_5. Low plate supply impedance minimizes phase shifts which may destroy the audio phase relationships at the input of the audio-phasing networks.

Under-chassis view of adapter, showing location of component parts.



Operating Characteristics

In receiving single-sideband suppressed-carrier signals which are transmitted with substantially no carrier, there is no automatic lock-in action of the local oscillator. The latter is set to the i.f. peak frequency, and the receiver tuned slightly in order to establish the correct frequency relationship to the transmitted single sideband. In practice, it has been found that the receiver tuning is not nearly so critical as at first might be expected. SSSC reception using the exalted-carrier technique is far less difficult than that obtained with usual methods involving the receiver beat oscillator. This is because the often-encountered restrictions imposed by limited b.f.o. injection are removed, thus permitting substantially distortionless demodulation of the single-sideband signal.

When receiving normal double sideband plus carrier transmissions in the absence of interference, either of the DSB or SSB positions may be used, and will yield about the same audio output. If interference is present on one or the other of the sidebands, selection of the appropriate SSB position will reject heterodynes and spurious interference components lying in the audio band between 80 and 3500 cycles. The absolute degree of rejection will depend to some extent upon the particular audio frequency or band of frequencies to which these components correspond, but will be not less than 23 db anywhere within this range. At frequencies between 200

(*Continued on page* 29)

Another important development from

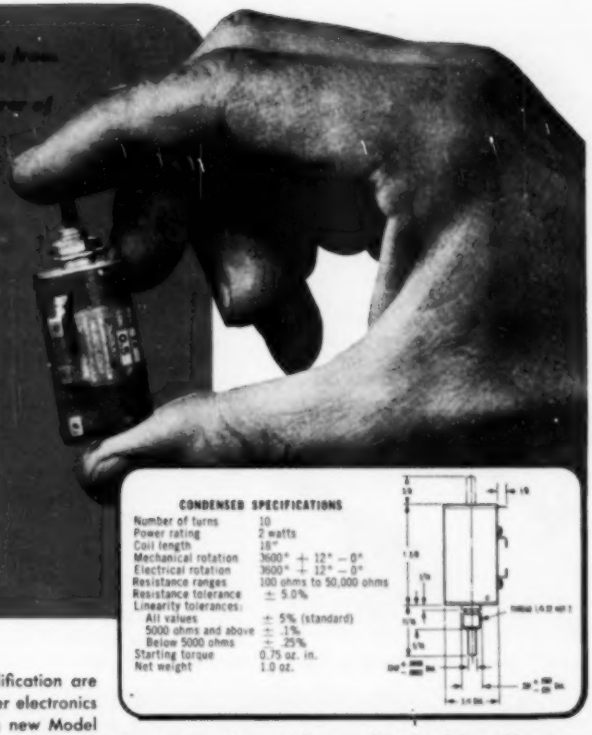
Helipot *world's largest manufacturer of precision potentiometers...*

TINY *in size— the diameter of a penny!*

BIG *in performance— 12 times the resolution of a conventional "pot."*

THE MODEL AJ

Helipot



CONDENSED SPECIFICATIONS

Number of turns	10
Power rating	2 watts
Coil length	1⅛"
Mechanical rotation	3600° + 12° − 0°
Electrical rotation	3600° + 12° − 0°
Resistance ranges	100 ohms to 50,000 ohms
Resistance tolerance	± 5.0%
Linearity tolerances:	
All values	± 5% (standard)
5000 ohms and above	± .1%
Below 5000 ohms	± .25%
Starting torque	0.75 oz. in.
Net weight	1.0 oz.

Miniaturization, weight reduction and circuit simplification are key design objectives in all airborne and many other electronics applications for precision potentiometers. Helipot's new Model AJ meets these needs with a compact potentiometer having over 12 times the resolution of conventional potentiometers of the same diameter . . .

- **SIZE AND WEIGHT: The AJ is only ¾" in diameter (small as a penny)—1⅛" long—weighs 1.0 oz. It requires only a minimum of valuable panel space!**
- **PRECISION, WITH CIRCUIT SIMPLICITY: On many applications the AJ replaces two conventional potentiometers, providing *both* wide range and fine adjustment in *one* unit. Its 18" slide wire gives a resolution of 1/3000 in a 100 ohm unit—1/6550 in a 50,000 ohm unit!**
- **RELIABILITY: The AJ is rugged and simple, is built to close tolerances with careful quality control. Its performance and reliability reflect the usual high standards of Helipot quality!**

MANY IMPORTANT CONSTRUCTION FEATURES: If you have a potentiometer application requiring light weight, unusual compactness, high accuracy and resolution, be sure to get the complete information on AJ advantages . . .

Here is a "pot" with bearings at *each* end of the shaft to assure precise alignment and linearity at all times. In addition, each bearing is *dust-sealed* for long life and is mounted in a *one-piece* lid and bearing design for exact concentricity.

Either single or double shaft extensions can be provided to meet individual needs —also, special shaft lengths, flats, screwdriver slots, etc.

Tap connections can be provided at virtually *any* desired point on the resistance element by means of a unique Helipot welding technique which connects the terminal to only ONE turn of the resistance winding. This important Helipot development eliminates "shorted section" problems!

BUILT TO HELIPOT STANDARDS

Helipot—world's largest manufacturer of precision potentiometers—has built an enviable reputation for highest standards in all its products, and the Model AJ is no exception.

The resistance elements themselves are made of precision-drawn alloys, accurately wound by special machines on a copper core that assures rapid dissipation of heat.

Each coil is individually tested to rigid standards, then is permanently anchored in grooves that are precision-machined into the case. Slider contacts are of long-lived Paliney alloy for low contact resistance and low thermal e.m.f. . . . and precious-metal contact rings are used to minimize resistance and electrical noise. All terminals are silver plated and insulated from ground to pass 1,000 volt breakdown test.

LONG LIFE: Although Unusually compact, the AJ is built throughout for rugged service. Potentiometer life varies with each application, of course, depending upon speed of rotation, temperature, atmospheric dust, etc. But laboratory tests show that, under proper conditions, the AJ has a life expectancy in excess of one *million* cycles!

Helipot representatives in all major cities will gladly supply complete details on the AJ—or write direct!

THE Helipot CORPORATION

South Pasadena 4, California

Field Offices: Boston, New York, Philadelphia, Rochester, Cleveland, Detroit, Chicago, St. Louis, Los Angeles and Fort Myers, Florida. *Export Agents:* Frohom Co., New York 18, New York.

NEW PRODUCTS

THERMOSTATS

Stevens Manufacturing Company, Inc., announces an addition to its line of positive-operating Type C bimetallic strip thermostats. Especially designed for applications in which moisture beads or other severe conditions preclude the use of ordinary thermostats, Type CH100 features an elec-



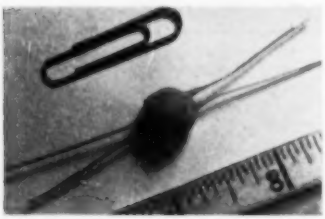
trically independent bimetallic thermal element.

Type CH100 units are for use in low-wattage circuits where precise thermal control is mandatory, as in electronic and communication equipment, control apparatus and appliances where moisture beads are a problem. They can also be made as a so-called "alarm thermostat," a double unit precalibrated to close the circuit at both a minimum and a maximum temperature.

Dimensions, performance curves and engineering data are available on request from the *Stevens Manufacturing Company, Inc.*, 69 South Walnut Street, Mansfield, Ohio.

MINIATURE PULSE TRANSFORMER

For use where space is at a premium, *P C A Electronics Incorporated* has designed a miniature pulse transformer



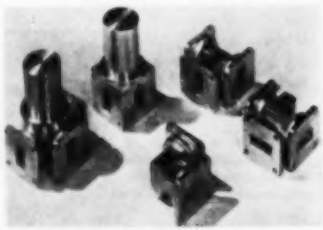
for low power application. The small size and weight of the unit permit direct mounting with its leads to the chassis.

Special features of the *P C A* pulse transformer are fast rise time, with a minimum decay providing a good waveform for specific pulse techniques. Product applications include airborne radar, guided missiles, electronic computers and other coded pulse sources.

A brochure describing detailed engineering data is obtainable upon written request to *P C A Electronics Incorporated*, 6368 DeLongpre Avenue, Hollywood 28, Calif.

MICROWAVE COMPONENTS

A line of specialized microwave components for use in radar, telecommunications, microwave experimentation and similar fields, has been announced by *General Precision Laboratory, Inc.* Typical units are a lightweight, high efficiency switch, supplied in either wave guide or solid block construction; a compact "twist and turn" elbow; and



improved broadband shunt and series tees. Facilities are available for development of components to fill specific systems requirements.

Units embody design principles which afford unusually low absorption and reflection losses over a 10% bandwidth. The aluminum construction minimizes weight, and all units can be used in pressurized systems.

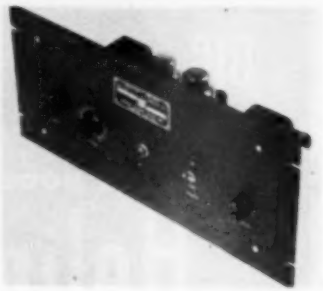
Further information may be obtained by writing to *General Precision Laboratory*, 63 Bedford Road, Pleasantville, N. Y.

INDUSTRIAL RECORDERS

A new industrial recorder, announced by *Offner Electronics Inc.*, 5320 N. Kedzie Ave., Chicago 25, Ill., and known as the Dynograph, offers a high speed, direct writing oscillograph and a special chopper-type amplifier which makes the machine completely drift-free. The Dynograph, used for simultaneous recording of rapid transients, operates at 100 times the speed of other recorders and has a pen deflection linearity of 1 per cent with pen response of 1/120th of a second.

LABORATORY AMPLIFIER

A versatile electronic tool, the relay-rack Type 221-A laboratory amplifier, has been announced by *Hermon Hosmer Scott, Inc.*, for industrial and scientific



laboratories. This amplifier features extended frequency response, high power output, and negligible hum and distortion.

Free bulletin may be obtained on request from *Hermon Hosmer Scott, Inc.*, 385 Putnam Avenue, Cambridge 39, Mass.

FAST-RISE PULSE GENERATOR

Designed for testing the transient response of wide-band systems, the Model 503 fast-rise pulse generator recently announced by *Spencer-Kennedy Laboratories, Inc.*, can also be used for the generation of impulse or "continuous spectrum" noise for signal-to-noise ratio testing, and for narrow-band receiver alignment.

Model 503 produces a rectangular pulse having a rise time of less than 10^{-8} seconds. The width of the pulse is



controlled by the external "width" cable, and may be as short as 2×10^{-8} seconds.

Further information can be obtained

from the *Spencer-Kennedy Laboratories, Inc.*, Dept. RT, 186 Massachusetts Avenue, Cambridge 39, Mass.

VARIABLE TRANSFORMERS

Much of the new electrical equipment, in order to conserve space and to keep weight to a minimum, is designed for



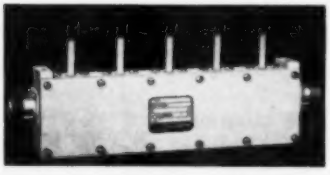
operation at frequencies of 400 cycles and higher. For use with this high frequency equipment, the *Superior Electric Company* offers a line of Powerstat variable transformers. The units are available in a multitude of voltage and current ratings in single and polyphase models.

If further information is desired, write to R. F. Greene, Advertising Manager, *The Superior Electric Company*, Bristol, Conn.

ATTENUATOR

The *Daven Company* announces the availability of its new radio frequency attentuator, Series RF-550. With two units connected in series, these attenuators are available with losses up to 100 db in one db steps. These units have a zero insertion loss and a frequency range from d.c. to 225 megacycles.

Standard impedances are 50 and 73 ohms, but special impedances are avail-



able on request. Resistor accuracy is within ±2% at d.c.

For complete information, write to the *Daven Company*, 191 Central Avenue, Newark, N. J.

MINIATURE MAGNETIC HEAD

The CRC miniature magnetic head, Model HA 102, was developed by *Computer Research Corporation*, 3348 W. El Segundo Blvd., Hawthorne, Calif., to provide higher component density in magnetic memory storage systems.

"Its small size, ¾" in diameter and 1" long, increases the number of heads that can be positioned around a magnetic drum, and permits shorter registers. The non-abrasive core, made from hard ferrite, will not injure magnetic drum coatings, nor will occasional scrapings damage the head. The unit operates at frequencies up to 120 kc., has 13.8 mh. total inductance, 11 ohms of d.c. resistance, and is stable over wide temperature ranges.

MINIATURE ROTARY SWITCH

A new miniature rotary switch, developed to meet the requirements of miniaturization in airborne electronic equipment, has been announced by the *Electro Development Corp.*, 6014 W. Washington Blvd., Culver City, Calif.

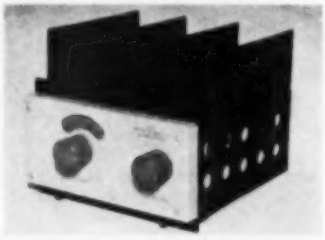
The Edco rotary switch has plastic, compression-molded parts for greater resistance to arcs than the commonly used phenolics. It is less than 1/10 the size of conventional switches, having a di-



ameter of ⅝" and thickness of 5/16". Contacts are of pure silver and the contact arm is silverplated beryllium copper, treated for maximum strength.

AIRBORNE RECEIVER

Gertsch Products, Inc., Los Angeles, Calif., has started to produce its new



Model AR-1 receiver, a five-tube, miniaturized, superheterodyne broadcast receiver designed especially for airborne use where light weight, small size, high sensitivity and good signal-to-noise ratio are needed.

RESISTORS

Printed resistors and resistance films of the carbon composition type, which range in value from 25 ohms per square to one megohm per square, are now

(*Continued on page* 28)



NEWS BRIEFS

CRYSTAL ANALYSIS UNITS

This photograph shows electrical connections being made on the main chassis of a crystal analysis unit at the Mount Vernon, N. Y., plant of *North American Philips Company, Inc.* Such x-ray diffraction equipment finds important application in the orientation of quartz



for piezoelectric oscillator plates used in communication systems, especially in aircraft and tanks, and on naval vessels.

COMPUTING LABORATORY

The Board of Education has announced the acceptance of grants totalling $200,000 from *General Motors Corporation* and *Ford Motor Company* for expansion and maintenance of the large-scale computing laboratory at Wayne University.

Wayne, which now has two large-scale computing machines, a "differential analyzer" and a "cinema integraph," will acquire a third one—a digital computer to be built by the *Burroughs Adding Machine Company*—with the $150,000 grant from *General Motors*. Wayne officials stated that the new machine would make possible a complete instructional program in large-scale computation.

The $50,000 grant from the *Ford Motor Company* will be used for operating expenses of the expanded laboratory.

NEW CORPORATION

Mr. Frederick T. Budelman and Mr. William Fingerle, Jr., in association with *French-Van Breems, Incorporated*, exporter of electronic equipment, have formed a manufacturing and engineering corporation for radio and electronic equipment. To be known as the *Budelman Radio Corporation*, the new corporation will engage in carrying out development contracts in the FM communications and multi-channel relay fields.

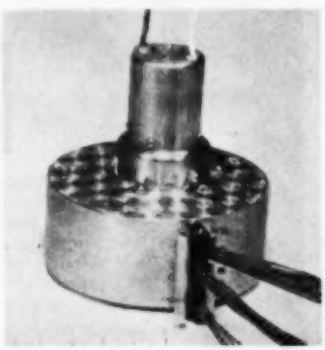
Messrs. Budelman and Fingerle, Jr., have previously been associated with the *Link Radio Corporation*, where they pioneered the development of FM communication equipment for the land mobile services and military applications.

The new corporation has established offices at 375 Fairfield Avenue, Stamford, Conn.

IN-FLIGHT CALIBRATOR

Designed to identify telemetered information from a guided missile in flight, the ten-channel in-flight calibrator recently developed by the National Bureau of Standards utilizes a system of cam-operated switches that eliminates many of the difficulties encountered in calibrators of comparable size and scope.

This device supplies four step-calibrating signals to the telemetering



record so that each received signal may be assigned finite values. Slow speed and fast speed cams sequentially activate switches that interrupt the normal channeling of telemetered information and pass calibration signals to the transmitter.

The initial model, which was designed by Messrs. L. L. Parker and W. A. Hereth of NBC, is now being manufactured by the *J. P. Seeburg Company*.

SMALL, LIGHTWEIGHT RADAR

The first radar ever to be produced on an assembly line basis, and the most widely used radar in the world today,



according to the *General Electric Company*, is the small, lightweight device now being manufactured at Syracuse, N. Y.

This *G-E* radar, which is credited with giving American jet pilots a decided shooting edge over enemy planes in Korea, eliminates guesswork on the part of the pilot. If the pilot keeps his enemy on the crosshairs of the computing gunsight, into which the radar feeds information, he is assured of a hit.

Conceived by *G-E* scientists shortly after the last war, the device is now being installed in Air Force, Navy and Marine Corps fighters throughout the world. Its use in Korea represents the first combat application of precision radar techniques to direct the firing of weapons from jet fighter planes.

NEW QUARTERS

Confronted with constantly increasing demand for research and manufacture in electronic and nuclear physics, the *Multi-Tron Laboratory* has moved to greatly enlarged quarters at 4624 West Washington Boulevard, Chicago, Ill. *Multi-Tron*, in addition to designing and manufacturing special purpose tubes, electron gun mounts and precision assemblies for vacuum tubes, is engaged in tool and die fabrication.

ENLARGED FACILITIES

Technical Associates, Inc., has just moved into a new, modern building at 140 West Providencia Avenue, Burbank, Calif., which provides more than three times the space of their original location. This company, a pioneer manufacturer of instruments for nuclear re-

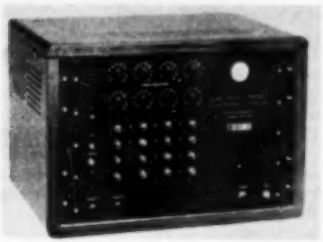
search, has long been a supplier to the Atomic Energy Commission and the Armed Forces. The enlarged facilities were made necessary by the expansion of production for government defense.

In February, 1951, *Technical Associates* purchased a substantial interest in the *Lyndsverk Electrometer Company*, and along with this affiliation, added research facilities and a new isotope department.

ELECTRONIC COUNTER

Greatly increased usage of predetermined electronic counters is announced by the *Potter Instrument Company, Inc.*, 115 Cutter Mill Road, Great Neck, N. Y., for applications where the rate of material flow is extremely rapid. The dual predetermining feature facilitates slowing down in the final stage of a cycle to obtain satisfactory operation of gates, shears and other devices.

The Model 243 dual predetermined counter will continuously recycle, accepting counts up to 1000 per second,



and reset instantaneously after each output operation without missing a count. Ease in pre-setting makes this counter readily adaptable to any production line.

NEW RECORDING STUDIO

A new, fully equipped, air-conditioned studio, with convoluted walls and blanketed ceiling for commercial recording and personal transcription, has been opened by *Magno Recording Studios*, 37 West 57th St., New York, N. Y.

The new studio, headed by Mr. A. J. Dash as manager, and Messrs. Ralph Friedman and Howard Warren, in charge of engineering, is a departure from conventional construction, and offers sound synchronization work in its sound-proofed, acoustically engineered studio.

RADIOACTIVITY INSTRUMENT

Eliminating the expensive and fragile moving-pointer microammeter generally used to indicate radioactivity levels, the National Bureau of Standards has developed a radioactivity instrument in which radiation levels are read directly from a potentiometer dial.

To read an unknown value of radiation on this instrument, which was developed for the Navy Bureau of Ships



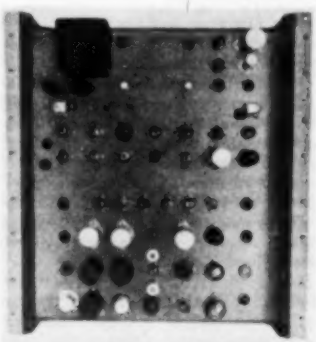
by Messrs. S. R. Gilford and S. Saito, the operator, wearing a small earphone, turns the dial to the point at which an audio oscillation begins. This indicating method is more convenient than a microammeter for plotting contours of equal radiation; leaving the dial set, the operator can locate a series of equally radioactive points as he walks along.

ELECTRONIC "MAGICIAN"

An electronic "magician" which can perform a number of video tricks and illusions has been created by the *RCA Engineering Products Department*, Camden, N. J. The new equipment, a special effects amplifier, can electrically accomplish fades, dissolves, superpositions, wipes, insertions, and other dramatic picture combinations at microsecond speed.

In the past, such programming effects have been achieved by systems of mirrors, sliding shutters, and various other elaborate contraptions. The new amplifier is expected to displace these optical and mechanical techniques.

RCA's special effects system consists of a single rack-mounted unit which



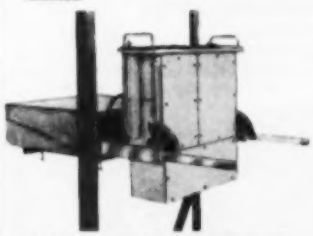
accepts the two video or picture signals to be mixed, together with a masking signal, and delivers the desired composite signal.

GRANT ELECTRONIC SLIDES SIMPLIFY SERVICING



The Dumont Telecruiser, a mobile TV station, features Grant Electronic Slides as a component part. Picture shows synchronizing generator and supply units which are mounted on Grant Slides. These units slide out for simplified servicing.

GRANT SLIDES ENABLE OPERATING PARTS OF UNIT TO BE ACCESSIBLE FOR MAINTENANCE.



Leading manufacturers of Electronic equipment as well as many government agencies have specified and successfully used GRANT SLIDES for many years.

Outstanding Features:

- Continuous ball bearing action
- Accurately fitted – no chassis rattle
- Pivoting and locking devices
- For loads from 25 to 2000 lbs.
- Time and manpower savings

GRANT PULLEY & HARDWARE CO.

31-83 Whitestone Parkway
FLUSHING, N. Y.

NEW LITERATURE

PRECISION POTENTIOMETERS

Two new product bulletins have been issued by the *Helipot Corporation*, South Pasadena, Calif. Bulletin No. 109 covers the new Model T—"The Tinytork"—small-sized precision potentiometer which combines minimum operating torque with reduction in cubic space and weight; Bulletin No. 115 describes the Model F single-turn potentiometer, featuring continuous mechanical rotation, minimum deadspot between the ends of electrical rotation, and versatile design.

THE "LINK" STORY

Link Radio Corporation, designer and manufacturer of electronic communications equipment, has prepared a 24-page brochure entitled "The Story of Link Radio and Its Engineers," which gives a brief pictorial story of the background of the organization and its engineering personnel. Shown in this booklet are photographs of the *Link* laboratories and technical facilities at 125 West 17th Street, New York 11, N. Y., as well as illustrations of several new products.

PRODUCTION CONTROL

Publication of a new 56-page book entitled "Production Control Systems and Procedures" has been announced



by *Remington Rand Inc.* Free to interested executives, this book details a method of materials control that results in a shorter production planning cycle while speeding production by eliminating the causes of varied delays on the production line.

Fully illustrated with typical forms and procedure charts, the book outlines complete procedures for engineering, production planning and progress, machine load, material and tool procurement and control. Included is a typical case history.

Interested executives can receive their copies by directing requests for publication X-1268 to *Remington Rand Inc.*, 315 Fourth Avenue, New York 10, N. Y.

PICKUPS

The pickups described in a new bulletin recently issued by *Consolidated Engineering Corporation* are widely used as primary sensing units in vibration and acceleration studies. Adequately designed to serve in such special cases as the testing of rocket or submarine equipment, they are equally adaptable for the more usual vibration checking in machinery, motors, vehicles or construction.

Bulletin CEC 1503 contains the answers to application questions regarding amplitude and accelerations, frequencies, nature of motion and range of temperature. A copy may be obtained from *Consolidated Engineering Corporation*, 300 North Sierra Madre Villa, Pasadena 8, Calif.

RCA PUBLICATIONS

The following technical publications have been released by *RCA's* Tube Department, Harrison, N. J.:

"*RCA* Kinescopes," (Form No. KB-1022), a new 20-page booklet covering *RCA's* complete line of picture tubes and including a replacement directory, a picture conversion chart and notes on tube conversions.

"TV Servicing," (Form No. TVS-1030), a new 48-page book on television trouble-shooting, tuner alignment, and circuit analysis.

"*RCA* Preferred Tube Types for New Equipment Design," a 4-page folder revised to include changes resulting from technological advances in tube design and application.

The first two booklets may be obtained from *RCA* tube distributors, or by sending 25 cents for "*RCA* Kinescopes" and 35 cents for "TV Servicing" to Commercial Engineering, *RCA* Tube Department, Harrison, N. J. The revised tube folder may be obtained on request from Commercial Engineering at Harrison.

ELECTROMETER SHUNT

A two-page bulletin describing the Model 2001 electrometer shunt has been released by *Keithley Instruments*, 3868 Carnegie Avenue, Cleveland 15,



Ohio. Available in any of seven standard resistance values, the new shunt permits quick conversion of the company's Model 200 electrometer to a micromicroammeter.

This bulletin lists specifications and includes connection diagrams for measurements of current, such as insulation leakage, in ion chambers, and in photoelectric cells.

POWER SOURCES

Sorensen & Co., Inc., now has available a new catalog giving full descriptions and up-to-the-minute ratings and specifications on its entire line of standard "Nobatrons"—electronically regulated d.c. power sources. Also included in the catalog is a comprehensive discussion of circuit theory and a description, with diagrams, of some of the many ways in which Nobatrons can be used.

Copies of the catalog may be obtained by writing to *Sorensen & Co., Inc.*, 375 Fairfield Avenue, Stamford, Conn.

ROTARY SOLENOIDS

A few of the many applications for Ledex rotary solenoids in remote control problems are described in a 4-page bulletin recently published by *G. H. Leland, Inc.*, Dayton 2, Ohio. Six models are manufactured which range in diameter from 1¼ to 3⅜ inches. Applications vary from snap-action tripping of airborne bomb releases to the actuation of rugged, hydraulic valves in heavy duty materials handling equipment.

Remote Control

(*Continued from page* 14)

sis comprises a two-stage amplifier which amplifies the tones from the control line. The output of this amplifier feeds into the three separate sharp bandpass tone amplifiers previously described. There is also incorporated on this chassis a ten-position stepper relay and its associated slow release relays in a typical telephone dialing system which is actuated by a similar system at the control point. There are two sets of contacts on these steppers, ten in each set, which select both the tuning operation and metering circuit and apply each to its respective control line. Metering is accomplished by suitable shunts placed in the grounded side of the circuits to be metered. The resulting sampling voltages fed down the metering line are on the order of 50 volts. Meters at the control point are of the 0—500 microampere movement type with scales corresponding to those in the transmitter. Line adjustment and compensation is accomplished by employing an ohmmeter type circuit, shunted at the remote end.

At the remote transmitter location, there is also a local tune chassis which allows all motor tuning to be carried out right at the transmitter during maintenance routine.

At the control point location, the equipment comprises the control panel. This panel, shown in Fig. 5, consists of ten meters with their associated toggle switches below each, the operation dialing system and its relays, three tone oscillators, a two-stage tone amplifier, and a power supply furnishing voltages

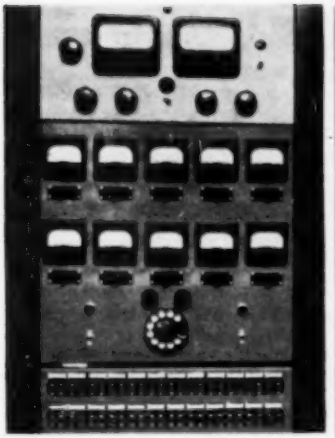
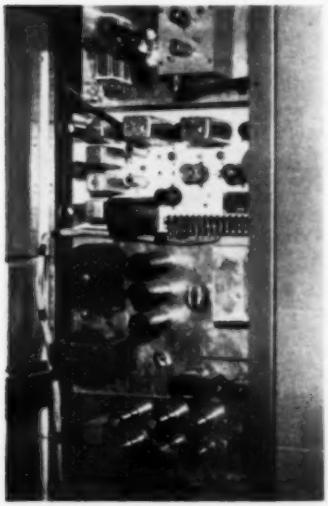


Fig. 5. Control panel with remote meters.

for relays, oscillators and amplifiers. A rear view of this panel is shown in Fig. 6.

Fig. 6. Rear view of control panel.



At the control location, the approved frequency monitor is installed. The type used is a *General Electric* Type BM 1 A. This particular frequency monitor requires approximately 3 volts r.f. input for proper operation. To obtain this level of r.f. at the control location, a Yagi beam cut to operating frequency was erected and fed to a specially constructed three-stage broadband r.f. amplifier which, in turn, feeds the frequency meter. Center frequency deviation and percentage of modulation, as well as audio monitoring, are obtained through the normal operation of the frequency meter.

In order to monitor continuously both the AM and the FM transmitters which are duplicating the program, an electronic multivibrator mixing system is being constructed which will alternately feed the output of both the AM and FM frequency monitors to a single monitoring speaker. The timing of this mixer will be approximately three seconds on each alternation.

The above summary of operations shows the versatility of this system. Although there would be some variation on different types of transmitters, it would be possible to duplicate these operations on practically any of the present commercial FM transmitters.

Such a remote setup must be situnted so that it is inaccessible to unauthorized persons, a requirement of FCC regulations concerning remote-controlled installations.

It is hoped that this article will call attention to the possibilities that remote control may have as a means of continuing FM broadcast service in cases where possible shutdowns have been contemplated.

LEEDS Our 29th Year
QUALITY – PRICE
DEPENDABILITY

POLYSTYRENE

ROD 12" LENGTHS

O.D.	Price	O.D.	Price
1/8	$ .03	3/4	$ .80
3/16	.06	7/8	1.15
1/4	.10	1	1.55
5/16	.16	1 1/4	2.30
3/8	.21	1 1/2	3.30
1/2	.40	1 3/4	4.50
5/8	.57	2	5.90

TUBING 12" LENGTHS

O.D.	I.D.	WALL	PRICE
1/4	1/8	.062	$ .07
5/16	3/16	.062	.10
3/8	1/4	.062	.13
1/2	3/8	.062	.18
5/8	1/2	.062	.23
3/4	5/8	.062	.29
1	7/8	.062	.38
1 1/2	1 1/4	.125	1.13
2	1 3/4	.125	1.50

Both Rod and Tubing also available in 48" lengths to order.

LEEDS RADIO CO.
75 Vesey Street Dept. RN-3
COrtlandt 7-3440 New York City 7

PURCHASING AGENT!
ENGINEERS!
EXPEDITERS!

When the pressure is on for that certain critical item in a big hurry, then let us be

"YOUR MAN FRIDAY"

and help share your load. We'll be the aspirin for that materiel headache.

ELECTRONIC PARTS
EQUIPMENT
ACCESSORIES

Authorized Distributor
Simplex Wire and Cable

— ALL MAJOR LINES —

JUST CALL OLYMPIA 8-2900
For Personal Service Ask For
Bernie Gardner
Phil Nardella — Sy Novak

"YOUR MAN FRIDAY"
CHANROSE RADIO
Distributors, Inc.
170-16 Jamaica Avenue Jamaica, N. Y.

TECHNICAL BOOKS

"ELECTRICAL ENGINEERING" —The Theory and Characteristics of Electrical Circuits and Machinery, by Clarence V. Christie, Professor of Electrical Engineering, McGill University. Sixth Edition. Published by *McGraw-Hill Book Company, Inc.*, New York, Toronto and London. 675 pages. $7.00.

While the latest revision of this book maintains the elementary approach of former editions, it is directed toward preparing and encouraging the student to extend his studies into more advanced phases of the subject. The emphasis is on the power field, but it is also intended for the student whose main interest lies in the field of communication engineering. All the material included in the previous edition has been retained, but a considerable amount of new descriptive material has been added and a number of additional problems have been worked out.

The treatment of a.c. circuits has been extended to cover some of the more important circuit theorems, and special types of d.c. machines are discussed. Treatment of the polyphase induction motor has been extended to include the main systems of speed control. The material on the mercury-arc rectifier has been brought up to date, and the study of system faults and stability has been made of more practical value by the inclusion of numerical examples.

"ALTERNATING-CURRENT MACHINES" by George V. Mueller, Professor of Electrical Engineering, Purdue University. Published by *McGraw-Hill Book Company, Inc.*, New York, Toronto and London. 502 pages. $7.50.

Designed for an undergraduate course in a.c. machines or for use by one who is beginning a study of the subject, this text presents an analysis of the construction and operating principles of transformers, polyphase induction machines, synchronous machines, single phase motors and rectifiers. Recent applications of high-frequency induction motors are covered.

The treatment is practical with a design viewpoint, and standard symbols and abbreviations are used throughout. The material on synchronous machines is based on the latest AIEE and ASA standards.

A large number of problems are included, each of which illustrates one or more principles. Oscillograms help to explain certain relations and to confirm results derived by mathematical methods.

New Products

(Continued from page 23)

being produced at *Glass Products Company*, 6911 S. South Chicago Avenue, Chicago 37, Ill. Wattage dissipation ratings are from one to five watts per square inch. Good aging properties are a characteristic of these printed resistors, and JAN specifications, as applied to the conventional carbon composition resistor, are readily met.

A precision film type resistor designed to operate at an ambient of 200°C at rated wattage has also been developed at *Glass Products Company*. This resistor is now being produced on a laboratory scale in one-half to five watt sizes.

SHUNTS

Three new shunts are offered by *Assembly Products, Inc.*, suitable for use with all types and makes of 50-millivolt meters and with Simplytrol contact meter relays, also manufactured by this company.

The three sizes, MSA, MSB and MSC, range from 30 amperes to 1200



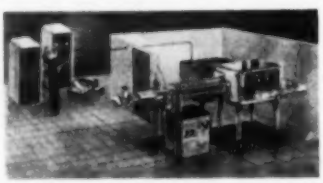
amperes. They are mounted on bakelite blocks for insulation to 1500 volts. Terminals are of ample size with large flat surfaces for good heat dissipation.

Catalog Sheet S-1 will be mailed on request by *Assembly Products, Inc.*, Chagrin Falls, Ohio.

PARTICLE ACCELERATOR

Operating at voltages up to 250 kv. and producing an intense beam of charged particles for neutron production, nuclear reactions and scattering experiments, the new Cockroft-Walton type particle accelerator has been announced by the *American Instrument Company, Inc.*

The machine operates effectively at any voltage from 20 to 250 kv. and delivers a focused beam of charged particles concentrated in a circle smaller

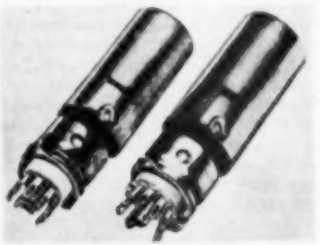


than one millimeter in diameter. Beams of a larger area with uniform current cross section may be obtained.

Additional information may be obtained from *American Instrument Company*, Publicity Department, Silver Spring, Md.

MILITARY TUBE SOCKETS

Military tube sockets are now being made available by the *Methode Manufacturing Corporation*, manufacturers



of electronic equipment for both military and civilian use. All *Methode* sockets meet applicable JAN specifications.

For further information, write to the *Methode Manufacturing Corporation*, 2265 West St. Paul Avenue, Chicago 47, Ill.

BW RESISTORS

The addition of BW resistors to the *Cinema Engineering Company's* resistor line has been announced. This new series is provided with solder lugs, and includes range sizes from single sec-

CALENDAR of Coming Events

MARCH 3-6—IRE National Convention, Waldorf-Astoria Hotel and Grand Central Palace, New York, N.Y.

MAR. 22-APR. 6—International Trade Fair, Navy Pier, Chicago, Ill.

MAR. 31-APR. 2—Sixth Annual NARTB Broadcast Engineering Conference, Conrad Hilton (Stevens) Hotel, Chicago, Ill.

APRIL 15-17—AIEE South West District Meeting, Jefferson Hotel, St. Louis, Mo.

APRIL 19—IRE Cincinnati Spring Conference, Engineering Societies Bldg., Cincinnati, Ohio.

MAY 5-7—RTMA, AIEE and IRE sponsored government—industry conference on Quality Electronic Components, Washington, D. C.

MAY 10—IRE New England Radio Engineering Meeting, Copley Plaza Hotel, Boston, Mass.

MAY 12-14—IRE National Conference on Airborne Electronics, Hotel Biltmore, Dayton, Ohio.

MAY 16-17—Fourth Southwestern IRE Conference and Radio Engineering Show, Rice Hotel, Houston, Texas.

MAY 19-22—Radio Parts and Electronic Equipment Show, Conrad Hilton Hotel, Chicago.

tion chapron-wound, to a 4-section resistor and multi-pi winding in the larger BW/1 type.

With resistance values of 1 ohm to 1 megohm, and wattage ratings varying from ¼ to 1 watt, the BW resistor is available in a variety of resistance wire alloys and impregnation treatments.

Further information may be obtained from the *Cinema Engineering Co.*, Burbank, Calif.

KLYSTRON POWER SUPPLY

Model KX, designed to power high-power klystron tubes, is being introduced by the *Polarad Electronics Corporation*, 100 Metropolitan Avenue, Brooklyn 11, N. Y. According to the manufacturer, it will be particularly useful with *Raytheon's* wide-band klystrons, such as the RK-5721.

The Model KX is mounted on a dish-pan type chassis provided for ease of access. The manufacturer will provide further details on request.

Exalted-Carrier

(*Continued from page* 20)

and 3000 cycles, the discrimination ratio approaches 36 db. The receiver thus behaves as though it had an equivalent selectivity characteristic similar to that of Fig. 6. This figure also shows the normal selectivity curve without the adapter. It can be seen that the apparent bandwidth of the receiving system has been effectively halved, yet because either sideband is accepted in its entirety (subject to the usual attenuation due to i.f. selectivity), the audio response has not been materially affected. Therefore, no loss of intelligibility results.

C.w. signals may be received in true single-signal fashion since the audio image is suppressed. The receiver b.f.o. is not used; instead the local oscillator in the adapter is detuned slightly from the i.f. peak frequency, and the receiver r.f. gain control backed down to the point where the local oscillator a.f.c. circuits are inoperative. Depending upon interference conditions, the DSB or either of the SSB positions may be used. In the latter case, the equivalent selectivity characteristics of Fig. 6 will be obtained.

Detection of phase- or frequency-modulated signals by the phase rotation method does not provide the high degree of suppression of random noise and spurious AM which characterizes limiter-discriminator and ratio detector systems. The audio recovery from an FM or PM signal in which the modulation index is not too large is, however, very much more satisfactory than that obtained with off-tune amplitude detection. Furthermore, because all i.f. circuits are synchronous-tuned to the mean carrier frequency, the effective signal-noise ratio is improved by at least 3 db.

The writer wishes to express his appreciation to Mr. Don Norgaard of the *General Electric Company* for permission to reproduce certain portions of the circuit design described herein.

REFERENCES

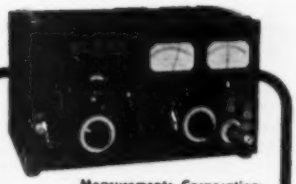
1. *Crosby, M. G., "Exalted Carrier Amplitude and Phase Modulation Reception," Proc. IRE, September, 1945.*
2. *Norgaard, D. E., "Practical Single Sideband Reception," QST, July, 1948.*
3. *Experience has indicated that a frequency difference of 10 to 20 cycles between the two carriers will not seriously impair quality of reception, provided the carrier suppression at the transmitter is 23 db or more.*
4. *Dome, R. B., "Wide Band Phase Shift Networks," Electronics, December, 1946.*
5. *A.R.R.L. Handbook, 1950, Chapter 9.*

Calorimeter

(*Continued from page* 12)

ing around the thermometer mercury bulb. Each thermometer base consists of finely ground glass which makes a very close and liquid-tight fit. Thermometers may be interchanged or others, with different scale divisioning, may be used at will.

Fig. 5 shows the rear view of the calorimeter developed by *Transport Products Corporation*, of Louisville, Ky., with the cooperation of the *Kahl Scientific Instrument Corporation*. At the top is a glass valve which is preset or changed at will to provide any amount of water flow rate in the system. Below the valve is the elaborate radiator for restoring heated water out of the water load to room temperature. Below this, in turn, may be seen a bulbous glass calibrating unit with a glass valve fitting at its bottom. In back of the calibrating unit can be seen the jet type version of water pump. The rectangular stainless steel case, on which is mounted the calibration and calibrating valve components, is the reservoir which holds the water needed for the over-all system. Normally, water is pumped out of the reservoir as per the flow diagram. Water is returned to the reservoir by allowing it to flow through the calibrating unit with the glass valve open. Whenever the flow rate is to be checked and the system calibrated, the glass valve is closed so that the water will fill up to the calibrating glass and overflow at its top into the reservoir. A stop-watch is used to measure the time it takes for water to fill up to the 100 cc. reference mark inscribed on the calibrating glass. A reference mark is also provided from which to commence the reading. For 500 watts power to be measured by a temperature rise of 40°C, 100 cc. of water should flow into the calibrating glass in 33⅓ seconds. The rate of flow may be increased or decreased by adjusting the glass valve at the top of the unit. This gives the calorimeter any desired degree of sensi-


Measurements Corporation
MODEL 80
STANDARD SIGNAL GENERATOR
2 Mc. to 400 Mc.
Individually Calibrated Direct-Reading Dial
FREQUENCY ACCURACY: ±0.5%
OUTPUT VOLTAGE: 0.1 to 100,000 microvolts.
OUTPUT IMPEDANCE: 50 ohms.
MODULATION: Amplitude modulation 0 to 30%. Internal modulation 400 and 1000 cycles. Provision for external pulse and amplitude modulation.
POWER SUPPLY: 117 volts, 50/60 cycles. 70 watts.
MEASUREMENTS CORPORATION
BOONTON NEW JERSEY


MISSILE
TECHNICIANS
for
FIELD TEST POSITIONS
in
NEW MEXICO
"The Land of Enchantment"
★ ★ ★ ★
ON
Guidance
Flight Testing
Servomechanisms
Telemetering
Test Equipment
Airborne Electronics Equipment
★
IDEAL WORKING CONDITIONS
WRITE: FIELD TEST DIRECTOR
P. O. BOX 391
HOLLOMAN AIR FORCE BASE
NEW MEXICO
BELL Aircraft CORPORATION

tivity and response to suit the wishes of the operator.

Fig. 1 shows all the controls normally needed to use the instrument. The thermometer at left is the "cold" thermometer, normally at room or reservoir temperature. The one at the right is the "hot" thermometer which reads the temperature of the water returning out of water load. Optionally, a reader control may be provided for moving a reference line along the thermometer to set cold temperature as zero reference on the hot thermometer, in order to facilitate computation of temperature rise. Pilot lights and toggle switches shown are for the circulating water pump and for the circulating fan to cool water in the radiator back to room temperature. In practice, the hot thermometer increases in reading with respect to the cold thermometer in a few seconds, and stabilizes at maximum temperature differential in three minutes or less for a flow rate of 179.15 cc. per minute against power measurements on the order of 50 to 100 watts average power. The thermometers shown are the most sensitive ever used in commercial calorimeters.

Operation

Operation is normally very simple. The pump is started by turning on the front panel toggle switch, which circulates water through the water load and around the bases of the input and output thermometers. After sufficient time has elapsed for water to travel completely through the water load and around the thermometers, a temperature differential develops between the two thermometers which otherwise would read the same. When this differential has stabilized, the temperature difference is read or determined, and reference is made to a calculated graph to determine the average power absorbed by the calorimeter, and thus the average power output rating of the device under test.

Future

Two of the interesting offshoot developments in the postwar wave guide art are "Microwave Calorimetry" and "Microwave Spectroscopy." When the two are combined, they become research tools which may point the way to the precipitation of matter suspended in liquids or gases. Already some interest is developing in such an approach for the freshening of sea water, leaving in certain elements and removing or modifying others, so that the result might be a product superior to ordinary fresh water. It may afford a more economical and superior method of removing superfluous matter in liquids by the use of molecular resonance rather than by high cost distilling or evaporation systems. Engineers at the laboratories of the *Technical Products and Services Company*, who are studying the effect on liquids circulated through water loads exposed to microwave energy in wave guides, have given these possibilities serious attention.

Another field of promise is the use of these water loads as r.f. power loads. Such loads minimize the limitations of present wave guide loads where absorbing materials, such as carbon-impregnated bakelite in the case of very low power, or concrete-graphite compositions in the case of medium power loads, develop excessive heat.

Modifications of this technique can also be used to measure electrical power regardless of frequency, such as in coaxial cables for lower frequencies.

Today, inasmuch as radars, microwave tubes, and nucleonic devices involve measurement of higher average power than was necessary in the past, the r.f. circulating water load as used in calorimeters affords the most convenient and economical solution to the problem of coping with the high heats involved.

Magnetic Tape

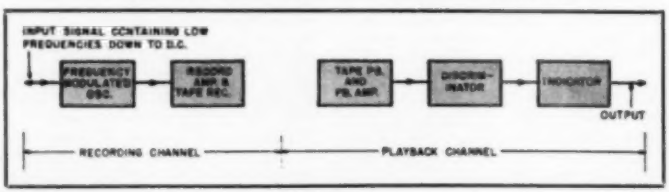
(*Continued from page 6*)

by audio-frequency recorders, which are not capable of reproducing low-frequency signals down to d.c. However, the use of frequency-modulated carrier techniques provides a method of recording such signals in multitrack systems, as shown in the block diagram, Fig. 11. A local oscillator in the recording channel is frequency-modulated by the input signal, and the modulated carrier recorded on the tape through the standard recording channel. In the playback channel, the carrier is demodulated by a discriminator so that the original signal is reproduced with frequency response down to zero cps. Since the entire recording channel is available for the frequency-modulated signal, the carrier frequency and the frequency deviation can be selected to take best advantage of the recorder bandwidth, using wide-band modulation to minimize the effects of speed variation of the tape, and a wide frequency range to give good high-frequency reproduction of the recorded signal. Such systems are capable of recording signal frequencies of 0 to 7500 cps with a signal-to-noise ratio of over 45 db below 3% harmonic distortion, and can give better signal-to-noise ratios for narrower-band signals.

Commercial units have been designed and are available for the multitrack recording systems which have been described. Photographs of some of these units are shown in Figs. 1, 7, 8 and 10. Fig. 8 shows a typical multitrack unit which records seven channels on ½-inch tape. As this unit was designed for field operation, it contains a tuning-fork oscillator and a power amplifier to provide accurate 60 cps driving power which may not always be available in the field. This supply also can serve to isolate the tape drive mechanism from any variations in commercial 60 cps power which might affect the accuracy of the data. Fig. 7 shows a photograph of a 13-channel recorder which has been used for the recording and reproduction of signals obtained in petroleum exploration and similar geophysical applications; these units use the frequency-modulated carrier system to give recorded frequency response to d.c. with an upper frequency limit which can be made as high as 20% of the carrier frequency. Fig. 1 shows a photograph of a laboratory signal-analysis reproducer which has a three-speed drive with eight-track reproduction on the horizontal table, while the vertical table permits rerecording of any two of the eight tracks with facilities for loop operation.

The various magnetic tape data-recording systems described in this article represent the different methods which have been found useful in a wide variety of applications. The specific system which is used in any single application depends upon the individual requirements, although in many cases the commercial availability of a recording unit may be the most important consideration. The methods and techniques which have been described should serve as a useful introduction to some of the techniques involved in the design and application of such data-recording systems.

Fig. 11. Block diagram showing use of frequency-modulated carrier techniques to provide a method of recording signals containing low-frequency components down to d.c. A single channel is shown.



Etching

(*Continued from page 9*)

with unloaded Q of 150 whereas a similar 220 microhenry coil etched from commercial copper-clad plastic laminate has a Q of about 50.

The advantages of the coil-lacquer-cloth circuiting process as compared to other printing techniques may be summarized as follows:

1. Connections may be designed for three dimensions.
2. Printing and etching may be done while the harness is in flat sheet form.
3. The raw stock is inexpensive.
4. Soldering may be done directly as with wire.
5. Ordinary maintenance may be practiced.
6. Mounting of the circuit after etching permits the use of various inexpensive and low-loss bases.
7. Processing is more conveniently done independent of a rigid base.

Of most importance is the fact that the circuit may be fabricated flat, permitting the use of a variety of graphic arts processes (all essentially two-dimensional), but may be folded into the three-dimensional forms required in the bulk of most electronic equipment. The standard components with lugs dispersed on several sides may be utilized with the prefabricated harness.

Many of the properties of this particular method derive from the flexibility of the thin backing which, of course, may be achieved by other means than the selective etching of metal foil. For example, some of the conductive silver paints can be printed and fired on asbestos cloth or papers.

A question often asked in the printed circuit field concerns the strength of the metal to laminate bond. Much effort has been expended in the field of adhesives since 1905, when F. C. Burgess developed a testing device to measure the adhesion of electroplated metals. Deposits on plastics have received less consideration. A review of existing literature coupled with a knowledge of the particular problem at hand suggested that two tests would be needed to obtain usable information. These tests were essentially (a) a straight pull perpendicular to the surface, and (b) a straight peel or rip perpendicular to the surface.

After studying test methods used in the field of adhesives, a method was selected which enables tests to be performed by applying an adaptive structure to commonly available equipment.

In ASTM Specification 429-39, such an adapter is described for addition to a standard tensile testing machine for the specific purpose of making adhesion tests of vulcanized rubber bonds to metal surfaces. Such an approach is indicated unless the amount of testing to be done is large enough to justify the construction of a complete lever-action machine.

An adapter was devised for use in connection with a standard laboratory press. This adapter merely reverses the direction of the force applied by the press so that a pull, instead of a press action, is provided as the platens are brought together. The adapter and press are shown in Fig. 6. The applied negative pressure may be deduced from the regular pressure gauge by an arithmetical relationship.

Two brass plugs in the technique here described are used interchangeably; one has an area of ½ square inch and the other an area of 1 square inch in order to cover roughly the range of forces to be measured without the necessity of changing the gauge on the press. A perforated piece is used to clamp the test piece face up in the apparatus. The plugs are secured to the metallized or metal-clad surface of the plastic by means of solder with a low melting point, to avoid damaging the bond between copper and laminate.

After placing the plug on the test piece, all of the metal cladding, except that under the plug, is removed by cutting around the circumference of the plug with a sharp scalpel and peeling off the excess copper. This stripping is necessary only for clad laminate and not for paint-type metallizations which are friable enough to break free in the plug area without precutting.

With the test piece in place, the adapter is placed in the press and pressure applied slowly enough for the reading on the gauge to be observed accurately just before the time of adhesion failure. (The addition of a maximum reading hand to the press gauge would increase the accuracy.)

It has also been considered necessary to develop a test for peeling or ripping the metal surfaces from the plastic laminate, which is started by release at some point on the surface. Both tests

PHOTO CREDITS

Page	Credit
1, 3, 5, 6	Audio & Video Products Corp.
4	Applied Science Corp. of Princeton
7, 8, 9, 31	Sylvania Electric Products Inc.
10, 11 (top), 12 (top)	Transport Products Corp.
11 (bottom)	De Mornay Budd Inc.
12 (bottom)	Kahl Scientific Instrument Corp.
15	National Bureau of Standards

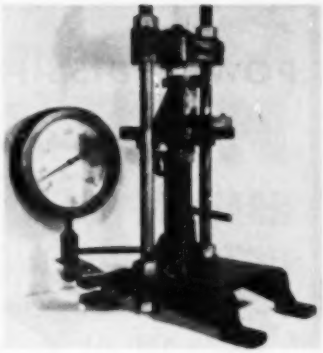


Fig. 6. Pull test adhesion adapter fitted to a laboratory press.

are necessary to gain enough information to establish controls on the materials and processes used to form circuits from these materials. A straight pull test is perhaps most appropriate for determining the relative performance of the materials put out by the various manufacturers, and for checking on the quality of such incoming raw material. While this test might also be applied to the material during processing, or to a finished product, it would not be representative of the most frequent type of destruction which is apt to occur to an etched circuit; namely, the pulling of a strip (connective wire) of copper from the surface after one end has been loosened by a ripping motion, such as might be applied by a component soldered to said strip.

The general method used for peel testing is to measure the force required to strip a given width of cladding at a given rate.

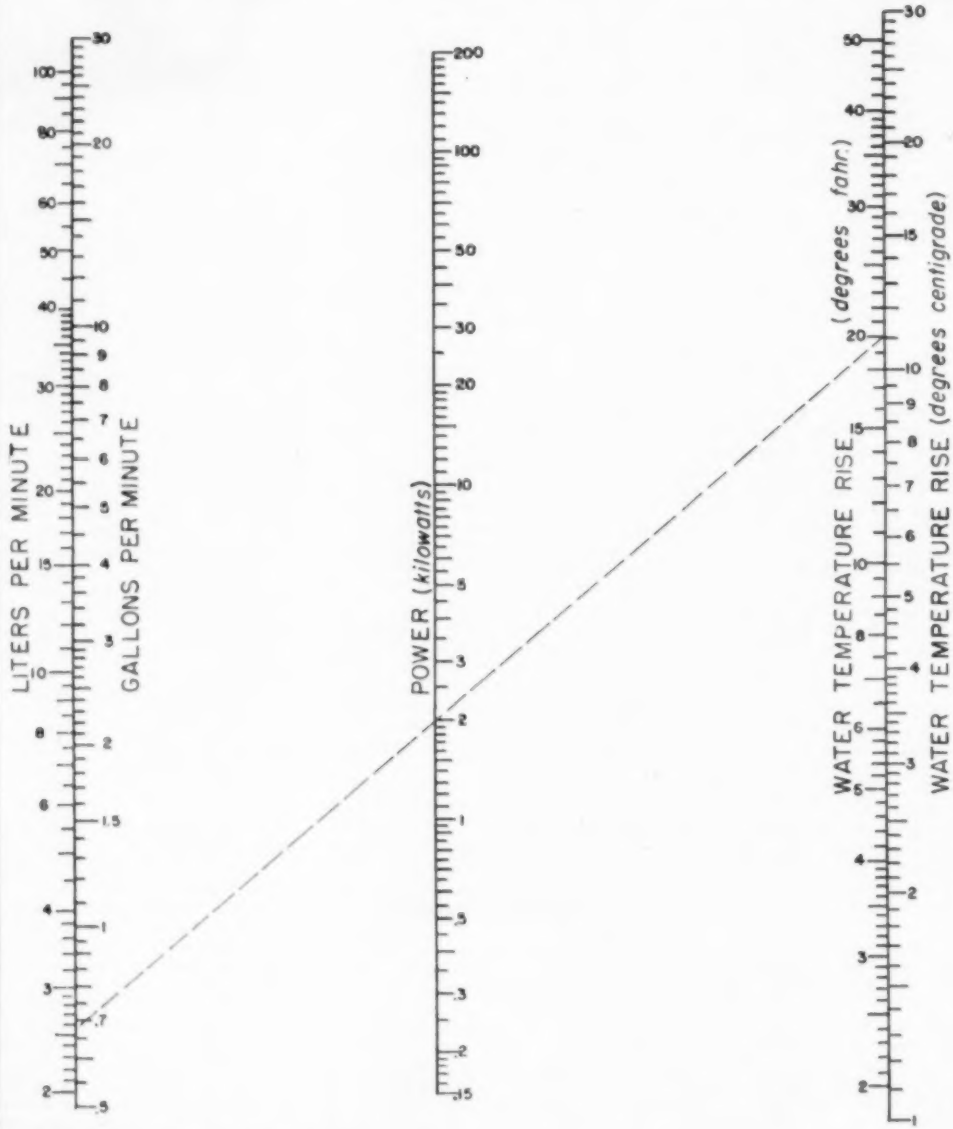
In conclusion, it may be stated that a practical laboratory procedure has been developed for the production of electronic products from commercial etching stock. This procedure may have to be modified to adapt it to commercial production.

Two tests have been developed for the testing of etching stock, for quality control and for establishment of new production processes. These tests may be used to check the product as it arrives, or after any phase of the processing. Typical bond strengths are 200 lbs. per square inch pull and 11 lbs. per inch width of peel.

Of the two tests, the peel test might be preferable because it more nearly approximates the damage that might occur to the circuit; the preparation necessary for sampling is simple, and the time per test is greatly reduced. Several commercial etching stocks have been tested and found to have sufficient strength for many practical applications.

POWER DISSIPATED IN WATER-COOLED DEVICES

Nomograph for determining power dissipation in kw. based on water temperature rise and rate of flow.



Courtesy of Federal Telephone and Radio Corporation.

Learn RADIO TELEVISION

–New Package Unit Plan– PAY AS YOU LEARN

NO MONTHLY PAYMENT CONTRACT TO SIGN!



I Send You 18 BIG KITS OF RADIO-TELEVISION EQUIPMENT



Approved for Veterans Under the G. I. Bill

TRAIN IN 10 MONTHS OR LESS
At Home in Your Spare Time

Now . . . be ready for Radio-Television's big pay opportunities in a few short MONTHS! Frank L. Sprayberry's completely new "Package" training unit plan prepares you in just 10 MONTHS . . . or even less! Equally important, there is NO monthly payment contract to sign . . . thus NO RISK to you! This is America's finest, most complete, practical training—gets you ready to handle any practical job in the booming Radio-Television industry. In just 10 months you may start your own profitable Radio-Television shop . . . or accept a good paying job in this fascinating expanding field at work you've always wanted to do. Mr. Sprayberry has trained hundreds of successful Radio-Television technicians—and stands ready to train you in less than one year, even if you have no previous experience. You learn by DOING . . . actually working with your hands with equipment of special design to illustrate basic theory instead of relying on books alone.

VALUABLE EQUIPMENT INCLUDED WITH TRAINING

The new Sprayberry "package" plan includes many big kits of genuine, professional Radio-Television equipment. While training you actually perform over 300 demonstrations, experiments and construction projects. In addition, you build a powerful 6-tube standard and short wave radio set, a multi-range test meter, a signal generator, signal tracer, many other projects. All equipment is *yours to keep* . . . you have practically everything you need to set up your own service shop. The interesting Sprayberry book-bound lessons and other training materials . . . all are yours to keep.

EARN EXTRA MONEY WHILE YOU LEARN!

All your 10 months of training is AT YOUR HOME in spare hours. Keep on with your present job and income while learning . . . and earn EXTRA CASH in addition. With each training "package" unit, you receive extra plans and ideas for spare time Radio-Television jobs. Many students pay for their entire training this way. You get priceless practical experience and earn generous service fees from grateful customers. Just one more reason why the Sprayberry new 10 MONTH-OR-LESS training plan is the best Radio-Television training in America today. If you expect to be in the armed forces later, there is no better preparation than good Radio-Television training.

FREE 3 BIG RADIO TELEVISION BOOKS



I want you to have ALL the facts about my new 10-MONTH Radio-Television Training—without cost! Act now! Rush the coupon for my three big Radio-Television books: "How to Make Money in Radio-Television," PLUS my new illustrated Television Bulletin PLUS an actual sample Sprayberry Lesson—all FREE with my compliments. No obligation and no salesman will call on you. Send the coupon in an envelope or paste on back of post card. I will rush all three books at once!

SPRAYBERRY ACADEMY OF RADIO
Dept. 25-G, 111 North Canal St., Chicago 6, Ill.

IF YOU ARE EXPERIENCED IN RADIO Men already in Radio who seek a short intensive 100% TELEVISION Training with FULL EQUIPMENT INCLUDED are invited to check and mail the coupon at the right.

Mail Coupon Today!

NO OBLIGATION
No Salesman Will Call

SPRAYBERRY ACADEMY OF RADIO, Dept. 25-G
111 North Canal St., Chicago 6, Ill.

Please rush to me all information on your 10-MONTH Radio-Television Training Plan. I understand this does not obligate me and that no salesman will call upon me.

Name.....Age.....

Address.....

City.....Zone.....State.....

Please check Below About Your Experience
☐ Are You Experienced? ☐ No Experience

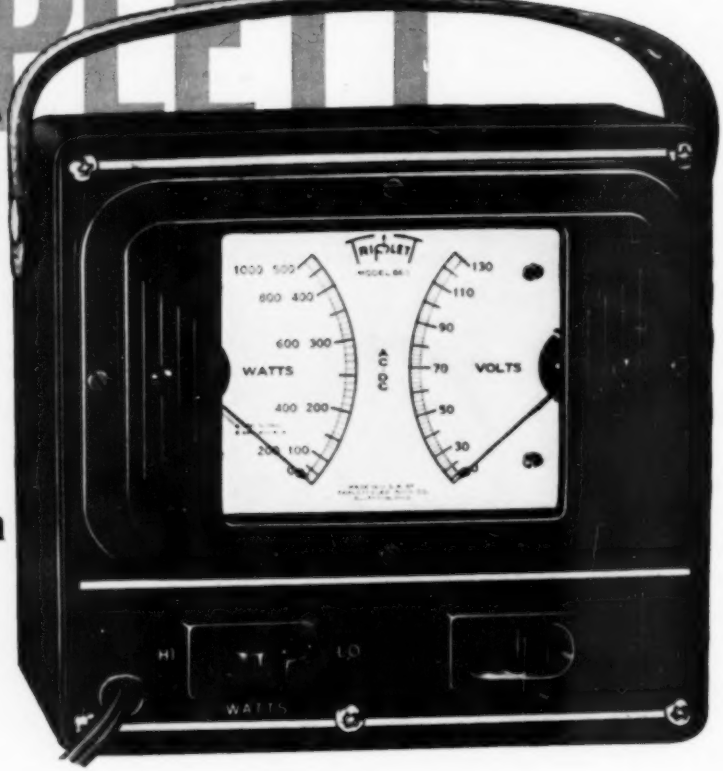
TRIPLETT

Load-Chek

introduces

Servicing by Power Consumption

MODEL 660



LOAD-CHEK *for the first time* makes it possible for every technician to utilize what is perhaps the simplest and quickest of all service methods—Servicing by Power Consumption Measurements.

Power consumption measurement has long been proved by auto-radio servicemen as a rapid method of localizing troubles in auto radios. But Triplett's new LOAD-CHEK is the *first* Wattmeter to be produced *at moderate cost*, and with the *proper ranges*, to bring this short-cut method within the reach of *every* radio and TV service man.

Basis of the LOAD-CHEK method is the tag or label on every radio and TV chassis which shows the normal power consumption. The following examples are only two of many time-saving uses of this new instrument.

LOCATING A SHORT—The chassis tag may show a normal consumption of 225 Watts. Simply plug the power cord of the chassis into LOAD-CHEK (there are no loose ends to connect or be in the way). Note the reading—which should be possibly 350 Watts. By removing the rectifier tube you can determine at once which side of the tube the short is on. With a soldering iron and long-nosed pliers you can check through the chassis, locate and correct the trouble without having to lay down tools or to check with lead wires!

REPLACING BURNED OUT RESISTORS—With the chassis to be repaired plugged into a LOAD-CHEK MODEL 660, note the wattage reading with the burned out resistor circuit open. Now replace the resistor. Should the increase in watts be greater than that of the resistor rating being installed, it indicates that an extra load has caused the trouble which has not been cleared.

LOAD-CHEK is made-to-order for the busy service man and can help stop costly "come back" repair jobs. It's a profit-maker because it's a Time-Saver. And at its moderate cost LOAD-CHEK can be standard equipment on *every* service bench. *By all means*, inspect this versatile instrument at your distributor and place your order, for under present conditions we must fill all orders on a basis of "First Come, First Served."

SEE MODEL 660 LOAD-CHEK AT YOUR DISTRIBUTOR'S

FOR THE MAN WHO TAKES PRIDE IN HIS WORK

Triplett





Servicemen can cover 94% of fuse replacements with this kit



One-Call Kit Contains 15 FT fuses (6 most in demand types) and 6 FT snap-in fuse holders in a clear plastic hinged-cover bench box. Another [illegible] set first. Call your jobber today. Littelfuse, Inc., 1777 Ravenswood, Chicago 40. LOngbeach 1-4970.

LITTELFUSE

hallicrafters

GUARANTEES 150-MILE T-V RECEPTION!

Model 1003—20" Mahogany. Smart new showpiece, with Full-View "Super Dynamic Tuner" control.
Model 1004—Same model, in Blond.



NO "NAMBY-PAMBY" CLAIMS! NO WEAK-KNEED PROMISES!

A MUST FOR YOU IN '52... FOR EXPANDING SALES!

The latest market studies show television sales saturations up to 71 per cent. That means you must "beat the bushes" for fringe business if you want to expand your sales during 1952. You need Hallicrafters . . . the ONLY television that GUARANTEES 150-MILE PERFORMANCE! Remember, Hallicrafters has the EXCLUSIVE, $2,000,000 Dynamic Tuner. This famous tuner, with its precision photo-etched circuits, delivers a clearness of picture and long-range performance unmatched by any other set!

hallicrafters

WORLD'S LEADING MANUFACTURER OF *PRECISION* RADIO & TELEVISION • CHICAGO 24



"I'm using the CBS-Hytron Easy Budget Plan, Joe. My CBS-Hytron distributor gave it to me."



"Tell me more."

"Well, CBS-Hytron's Plan helps me sell TV picture tubes and service to many a customer who just doesn't have $50 cash. Now I make sales I'd lose otherwise. My customer pays for the job painlessly a few dollars a month. Yet I get my cash right away — and can discount my bills with my distributor."



"Fine! How does it work, Sam?"

"Simple. I introduce my customer to the finance company authorized by CBS-Hytron. The finance company does the rest. Acts as my credit department to secure me against losses. Takes care of all the details . . . paper work, collections, etc. My customer gets his tube and I get my cash — at once."

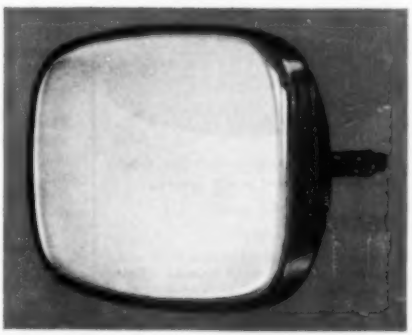


"That's swell, Sam. Now I can see why you always have plenty of working capital."

"That's right. And talk about service! This CBS-Hytron Easy Budget Plan has even brought me immediate cash from old accounts I'd written off as bad debts. CBS-Hytron is perfectly willing, too, that my regular budget loans include my service work and other components besides CBS-Hytron tubes. I owe my CBS-Hytron distributor a vote of thanks for letting me in on this wonderful Plan."



"Fair enough! I've sure been losing sales I shouldn't, Sam. I need the CBS-Hytron Easy Budget Plan. CBS-Hytron tubes are tops, too. Thanks for the tip. I'll see my CBS-Hytron distributor today."



SAVE THE SALE No need for *you* to miss a single profitable picture-tube sale . . . just because your customer does not have the cash. Get the details on this original CBS-Hytron service for you. See *your* CBS-Hytron jobber . . . or mail this coupon . . . today!

HYTRON

A DIVISION OF COLUMBIA BROADCASTING SYSTEM, INC.

CBS HYTRON

MAIN OFFICE: SALEM, MASSACHUSETTS

HYTRON RADIO & ELECTRONICS CO.
SALEM, MASSACHUSETTS

Please rush me details on the CBS-Hytron Easy Budget Plan.

NAME .....
(Please print)

STREET .....

CITY ..... STATE .....

FAST
TELEVISION
Tuner Alignment
to Crystal Accuracy

HICKOK



MODEL 680

R. F. MARKER and
CRYSTAL CALIBRATOR

EXCLUSIVE — Contains Magic Eye circuit for calibrating and crystal accuracy.

FEATURES

- Provides accurate alignment of RF and overall sections of a TV receiver. 53-89 MC and 173-217 MC on fundamentals.
- Harmonic output on UHF and VHF.
- Will calibrate any other generator to crystal accuracy by means of a built-in magic eye zero-beat indicator.
- 2.5 MC crystal supplied — 2 other crystal holders provided.
- Permits adjustment of frequency of TV local oscillators to crystal accuracy.
- Moderately priced — the 680 will prove to be a valuable investment in modern TV equipment.

See the 680 at your jobber's today, or write for full details.

THE HICKOK ELECTRICAL INSTRUMENT CO.
10524 Dupont Ave. • Cleveland 8, Ohio

Within the INDUSTRY

BERNARD TULLIUS was recently appointed sales engineer for the transmitter division of the *Allen B. Du Mont Laboratories, Inc.*



In his new post Mr. Tullius will act as a sales and technical counselor to *Du Mont* clients, aiding them in planning, laying out, and installing u.h.f. and v.h.f. transmitter equipment, coordinating transmitter design and construction work, and supervising field work of many kinds.

He has a comprehensive background in both AM and TV broadcasting and in engineering fields. He was formerly station and transmitter engineer for several Oklahoma City stations, has served as a field engineer for *Hazeltine Electronics*, and has been an instructor in television at the *Eastern School of Radio and Television*. Before joining *Du Mont*, he was a senior engineer at *Radio Engineering Labs* in Long Island City, N. Y.

• • •

ADMIRAL CORPORATION of Chicago has purchased the **MOLDED PRODUCTS CORP.**, one of the largest custom molders of plastics in the country. The plastics firm, which is located at 4533 W. Harrison Street in Chicago, will be operated as an **ADMIRAL** subsidiary.

• • •

RTMA's Transmitter Division has been reorganized to better serve the expanding electronics industry, according to H. J. Hoffman, *Machlett Laboratories, Inc.*, chairman of the division.

The division's executive committee has voted to recommend to the RTMA board of directors that the name of the Transmitter Division be changed to Technical Products Division. They also established a government relations section, under Ben Edelman of *Western Electric Co.*, to deal with problems of electronics manufacturers handling government contracts. In addition, the committee established a new general communications section, under James D. McLean of *Philco Corp.*, which will absorb the former marine and aviation sections as well as the former general communications section.

• • •

ELECTRONIC INSTRUMENT CO., INC., has purchased a six-story plant at 84-86 Withers Street, Brooklyn 11, New York, which will add more than 30,000 square feet of factory and office space to the company's facilities for producing "*Eico*" test equipment kits and instruments . . . **BENDIX RADIO DIVISION** has opened offices at 261 McDougall Avenue in Detroit to enable the company to work more closely with auto manufacturers in the design and production of auto radios. V. C. Judd is in charge of the new office which will also handle the company's entirely new line of mobile communications equipment . . . **BURLINGAME ASSOCIATES**, 103 Lafayette Street, New York, N. Y., has acquired an additional floor at that address to handle its increased business as representatives of some of the country's leading electronics manufacturers . . . **RCA VICTOR DIVISION** has established a West Central Region with headquarters in Kansas City. The new regional office, which is in charge of V. A. Kamin, will handle the Denver, St. Louis, Omaha, Des Moines, Sioux Falls, and Kansas City distributing areas . . . To house its rapidly growing Communications and Electronics Division, **MOTOROLA INC.** of Chicago has purchased a new 200,000 square foot plant at 4501 Augusta Blvd. in Chicago. The new plant is immediately adjacent to the company's main radio and television factory . . . **INSTRUMENT CORPORATION OF AMERICA** has opened a new and modern plant in Blacksburg, Va. to handle the production of miniature slip ring and commutator assemblies.

• • •

EDWIN D. FOSTER has been elected to the post of vice-president and director of planning for the *RCA Victor Division* of *Radio Corporation of America*.



The postwar growth and rapid expansion of the company's production facilities, brought about by the increasing demands for military electronic equipment as well as consumer products and services, has led to the establishment of a separate department devoted to business and economic planning.

As director of this new department, Vice-Admiral Foster (U.S. Navy, Ret.), will consult with product department executives on business and economic trends as they affect long-range planning of products, services, and markets.

Prior to this new assignment, Vice-Admiral Foster served as director of the company's mobilization planning department.

• • •

THE ELECTRONIC PARTS SHOW'S 1952 program is being planned to give the country's electronics parts distributors a role in determining what subjects they wish discussed at the semi-

Walter Ashe

HEADQUARTERS FOR National

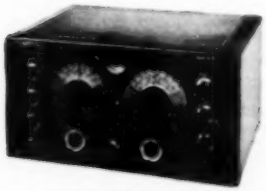
© NC EST. 1914

Whether you are a beginner or an old-timer, National is the equipment for you and Walter Ashe is the place where you can buy it at a record-breaking saving with a "Surprize" trade-in allowance. Trade used factory-built test or communication equipment now. What have you got to trade? Wire, write, phone or mail the handy coupon today.

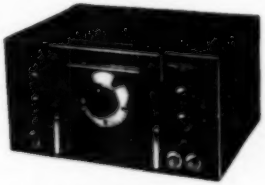


HOUSE OF Surprise TRADE-INS

A COMPLETE SERVICE
Our 4-story building is stocked with everything in Radio, Electronics, Parts and Supplies for Industry — Schools — Gov't Agencies and Research Laboratories.



NATIONAL NC-183
Shpg. wt. 64 lbs.
Only $279.00 less speaker



NATIONAL HRO-50T1
Shpg. wt. 88 lbs.
Less speaker Only $383.50



NATIONAL SW-54
Shpg. wt. 10 lbs.
Only $49.95



NATIONAL NC-125
Shpg. wt. 36 lbs.
Less speaker Only $149.50

FREE CATALOG!

164 value-crammed pages of everything in Radio and Electronics for Industry, Schools, Laboratories, Radio Stations, Service Technicians and Amateurs. The "treasure chest" of values.

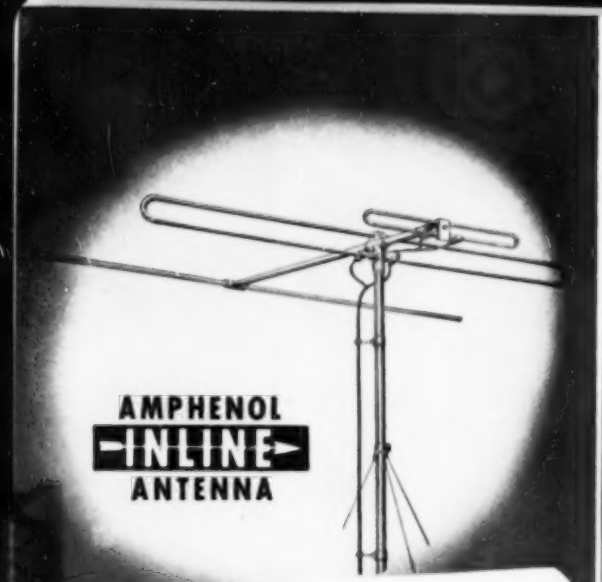


ALL PRICES F. O. B. ST. LOUIS • PHONE: CHESTNUT 1125

Walter Ashe RADIO CO.
1125 PINE ST • ST LOUIS 1 MO.

Walter Ashe Radio Co. RTN-52-3
1125 Pine St., St. Louis 1, Mo.
☐ O. K. Walter, Rush "Surprise" Trade-in offer on my
for _____
(show make and model No. of new equipment desired)
☐ Rush Free Copy of your new Catalog.
NAME _____ ADDRESS _____
CITY _____ Zone _____ STATE _____

SEND FOR YOUR COPY TODAY!

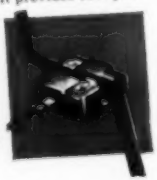


Be Sure
ANTENNA INSTALLATIONS are Safe

Safety is a factor too often overlooked in many TV antenna installations. Bent or broken antennas are a constant menace and antennas that break off or topple over under any undue strain can cause serious damage. Installing an Amphenol Inline Antenna is your guarantee of all-around quality! Not only does the Inline Antenna present the best possible TV picture, but it is safe! The Inline Antenna is constructed of aluminum for light weight and strength, and is engineered to withstand winds up to 70 miles per hour. In addition, it will bear up to one-half inch annular ice loadings without bending or breaking.

LIGHTNING ARRESTOR

Using an Amphenol Lightning Arrestor on the lead-in from your Inline Antenna makes your antenna installation secure in all ways. It provides real protection to your home and TV set from lightning damage and carries off the minor static discharges which interfere with good picture reception. The Amphenol Lightning Arrestor is of the type approved by the National Electric Code and is also approved by the Underwriters' Laboratories.





See your regular Amphenol Distributor now for your copy of this 20-page book containing all the factors which determine Better TV Picture Quality and safe antenna installation.

AMERICAN PHENOLIC CORPORATION
1830 SOUTH 54th AVENUE • CHICAGO 50, ILLINOIS

AMPHENOL

nars and group educational meetings to be held May 20 and 21 in connection with the Show.

Questionnaires have been forwarded to distributors and the committee, headed by Jack A. Berman of *Shure Brothers, Inc.*, will consider the replies carefully in making up the two-day agenda of seminars and discussion periods. To assist the distributors in evaluating the various topics under consideration for discussion at the seminars, the educational committee listed a number of major proposed subjects. On the basis of the distributors' judgment as to their timeliness, the proposed topics or those suggested by the distributors themselves will be offered on the program.

The 1952 Electronics Parts Show will be held at the Conrad Hilton Hotel in Chicago from May 19 through 22.

• • •

PHILIP BARNES is the new director of the *Weston Electrical Instrument Corporation's* sales division.

Formerly general sales manager of the company, Mr. Barnes has been associated with *Weston* for 16 years. Following his return from active duty in the U. S. Navy during World War II, he became advertising manager and then general sales manager for the firm.



At the same time Mr. Barnes' new appointment was made public, the company announced that Hubert M. Ricks had been named general sales manager, succeeding Mr. Barnes. Mr. Ricks has been associated with the company for 26 years.

• • •

INDIA'S INTERNATIONAL RADIO AND ELECTRONICS EXHIBITION which had been scheduled to take place during February 9th to 29th has been postponed to November 10th to 30th, 1952.

Further details about the exhibition are available from The Secretary, International Radio & Electronics Exhibition of India, Fateh Manzil, Opera House, Bombay, India.

• • •

FRITZ A. FRANKE is the new assistant radio sales manager for *The Hallicrafters Co.* . . . **NICHOLAS DEFALCO** has been appointed manager of the receiver quality control department of *Allen B. Du Mont Laboratories, Inc.* . . . **IVOR M. LESLIE** has been elected to the dual post of vice-president and director of *Crosley Radio and Television, Ltd.*, Canadian subsidiary of *Avco*. His new title is that of general manager . . . *E. I. Guthman Company, Inc.* has added two men to its Attica, Indiana factory staff. **A. SCHWARZKOPF** is the new plant manager and **ROBERT MOORE** has taken over the job of production engineer . . . **ARMIN P. BUETOW**, general manager of *Magnecord, Inc.*, has been named executive vice-president of the organization. He joined the company in January of 1951 . . . **IRWIN WEINSTEIN**, formerly assistant chief engineer of the *Sarkes Tarzian* rectifier division, has joined the staff of *Electronic Devices, Inc.* as assistant sales manager . . . **ROGER BROWN** is the new national sales manager of *Emerson Radio and Phonograph Corporation* . . . **HENRY C. ROEMER**, executive vice-president of *Federal Telephone and Radio Corporation* since September, 1950, has been elected president of the firm, the manufacturing associate of *I. T. & T.* . . . **IRVING G. ROSENBERG** has been appointed director of operations for *Allen B. DuMont Laboratories, Inc.'s* television receiver and cathode-ray tube divisions. He has been with the company since 1942 . . . **FERDINAND W. SCHOR** has been named chief engineer in charge of military engineering for *Motorola, Inc.* of Chicago . . . The appointment of **DR. COURTNEY PITT** to the post of vice-president-finance has been announced by *Philco Corporation* . . . **ROBERT E. LEE**, manager of finance for the *General Electric* Tube Department in Schenectady, has been appointed assistant manager of the company's cathode-ray tube operations . . . **FRED T. CALDWELL**, for many years a senior officer and director of *International Telephone and Telegraph Corporation*, passed away recently in New York City. He had been associated with *I. T. & T.* in various capacities since its founding in 1920 . . . **IRVING ROBBINS** has been named vice-president and general manager of

(*Continued on page* 88)

the only complete catalog for everything in Radio, TV & Industrial Electronics



your 1952 free! ALLIED 212-page value-packed catalog

Send for it today!

Here's the *one* authoritative, complete, up-to-date Buying Guide to TV, Radio and Industrial Electronics. Make your selections from the world's largest stocks of quality equipment at lowest, money-saving prices. See the latest and most complete presentation of electronic apparatus: new TV, AM and FM receivers; High-Fidelity Custom Sound components; latest P.A. Systems and accessories; recorders; fullest selections of Amateur receivers and station gear; specialized industrial electronic equipment; test instruments; builders' kits; huge listings of parts, tubes, tools, books—the world's *most complete stocks* of quality equipment.

ALLIED gives you *every* buying advantage: speedy delivery, expert personal help, lowest prices, liberal time payment terms, assured satisfaction. Get the latest 1952 ALLIED Catalog. Keep it handy—and save time and money. Send for your FREE copy today!



the world's largest stocks

- Radio Parts Unlimited
- Test Instruments
- Television & Home Radios
- P.A. and Hi-Fi Equipment
- Amateur Station Gear
- Builders' Supplies
- Equipment for Industry

quick, expert service



free *SEND TODAY FOR RADIO'S LEADING BUYING GUIDE*

ALLIED IS YOUR TV and HI-FI HEADQUARTERS

TV

Count on ALLIED for the latest in TV! If it's made—we have it for quick delivery. We specialize, too, in High-Fidelity sound components—everything in amplifiers, speakers, tuners, phono gear and accessories. For TV or Hi-Fi—think of ALLIED!

HI-FI

ALLIED RADIO

the World's Largest Radio Supply House

EVERYTHING IN ELECTRONICS

ALLIED RADIO CORP., Dept. 1-C-2
833 W. Jackson Blvd., Chicago 7, Illinois

☐ Send FREE 212-page 1952 ALLIED Catalog No. 127.

*Name*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

TRAIN AT HOME FOR

DO BETTER WORK...MAKE MORE MONEY with modern service methods!



A complete, 1-volume service training course in time-saving *professional* methods

only $6.75

The New Ghirardi

RADIO & TELEVISION RECEIVER

Troubleshooting and Repair

820 pages, 417 clear illustrations, price only $6.75

Here's the book you've been waiting for . . . *the new Ghirardi guide to servicing by professional methods!*

In a way that could only be matched by having one of the world's greatest instructors at your side, it explains every phase of modern servicing procedure. Fully modern, profusely illustrated, RADIO AND TV TROUBLESHOOTING AND REPAIR covers all TV, FM, AM, Phonograph and recorder servicing procedures. For the beginner, it is a complete training course. For the busy serviceman, it is a quick way to brush up on specific types of work or to find fast answers to puzzling service problems.

THE GREATEST HOW-TO-DO-IT SERVICE BOOK EVER WRITTEN!

First you get a full analysis of components and why they fail. Next you learn the most modern servicing methods—from static tests to dynamic tests using signal tracing and injection techniques. You'll learn how to set up a basic servicing procedure and to interpret performance data. Four big chapters show how to realign TV, FM, and AM receivers with a minimum of tools and equipment. Now that components are becoming scarce, you'll appreciate the chapters on how to *repair* as well as to replace defective transformers, chokes, loudspeakers, coils, controls, resistors, etc. You learn how a glance at a TV receiver may quickly tell you what is wrong, how to understand 3-way portable radio filament circuits, what to do about intermittent troubles, how to check ac/dc and transformerless power supply heaters *professionally*; how to handle fading and propagation troubles — and dozens of others. In short, no really practical service procedure has been omitted from this great book—and all are handled so that you can't fail to understand them!

Money-saving Combination Offer



Have the service data you need at your fingertips *when you need it!* Make your service library complete! Get both the new Ghirardi Radio & Television-Receiver TROUBLESHOOTING AND REPAIR ($6.75) and the Ghirardi Radio & Television Receiver CIRCUITRY AND OPERATION ($6.00) at the special price of only $11 for the two books. Check *SPECIAL COMBINATION OFFER* in coupon for 10-day examination privilege. You don't risk a cent.

PASS SERVICE LICENSE EXAMINATIONS!

Many cities now require servicemen to pass rigid license examinations. Let these two great new Ghirardi books help prepare you today to pass any such examinations with flying colors!

LEARN BASIC RADIO and TV CIRCUITS from A to Z

. . . and watch service troubles disappear

Actually, there are only a few really basic circuits in radio and TV receivers. Learn these from A to Z and even the most complicated of the countless modern circuit variations won't bother you. You'll work faster, better—more profitably!

HANDLE TOUGH JOBS IN ⅓ THE USUAL TIME!

Backed with what you can learn from A. A. Ghirardi's great new book, RADIO AND TELEVISION RECEIVER CIRCUITRY AND OPERATION, you'll find that nine out of ten difficult service jobs are tremendously simplified.

Starting with a clear explanation of AM and FM processes and characteristics, it progresses to a complete understanding of ALL basic circuits, shows how they operate, teaches you to recognize them quickly. Guesswork is eliminated. Laborious testing is greatly minimized. By making it easy for you to understand each circuit and its relation to other circuits, Mr. Ghirardi helps you go right to the seat of the trouble with far less time and effort. You'll know what to look for—and you'll have what it takes to enable you to repair troubles faster and more efficiently.



Ghirardi's new

RADIO AND TELEVISION RECEIVER

Circuitry and Operation

669 pages, 417 illustrations, price $6.00



36 COURSES IN ONE

Ghirardi's world famous RADIO PHYSICS COURSE 972 pages, 308 illus. 836 self-test review questions. Price only $5

COMPLETE BASIC TRAINING for BEGINNERS

More people now in Radio-TV got their basic training from this book than any other book or course of its type!

"The most complete training course in radio fundamentals ever offered"—that's what the experts say about Ghirardi's world-famous RADIO PHYSICS COURSE. More widely used by Signal Corps, Navy, etc., in World War II, than any other basic radio training text. Everything is explained so clearly that you can understand every word without previous radio training of any kind. Ghirardi's *Radio Physics Course* starts with Basic Electricity. Then it takes you step by step through the entire field of Radio-Electronics from simple circuits showing the basic functions of resistors, condensers, coils, transformers, etc., to the final applications of these circuits in home, auto, and aircraft radios, public address systems, sound motion pictures, etc. Subjects covered include Sound, Speech, Music, Electron Theory, Electric Circuits, Current, Resistance, Capacitance, Inductance, Transformers, Filters, Radio Waves, Vacuum Tubes, Radio Circuits, Loudspeakers and dozens of others. You get exactly the training you need—at a price you can afford to pay. If broken into "course" form and sent as monthly lessons, you'd regard it as a bargain at $50.00 or more. Instead you buy it for only $5.00—and you progress as fast as spare reading time permits.

Let these great books give YOUR earning power

HIGHER PAY in 1952!

Read any of these 12 great money-making books for 10 days AT OUR RISK . . . You be the judge!

IT PAYS TO KNOW HOW TO USE THE OSCILLOSCOPE



Modern Oscilloscopes and Their Uses

by Jacob H. Ruiter, Jr.

326 pages, 370 illustrations, dozens of pattern photos. $6.00

Now you'll really know how to use the greatest, most versatile service instrument of all—the oscilloscope! MODERN OSCILLOSCOPES AND THEIR USES gives you expert knowledge of scopes, helps you work faster, more accurately and more profitably on all sorts of service and laboratory jobs. No involved mathematics or theory! First, the author explains the construction and operation of cathode ray tubes and basic oscilloscope circuits. Then he gets right down to earth in telling exactly how to use a scope for AM, FM, and TV service work—from locating receiver troubles to aligning and adjusting the most complicated circuits. Dozens of actual pattern photos plus an unusually descriptive text teach you exactly how to analyze and interpret various patterns.

Don't let the oscilloscope "stump" you! Learn to use it fully for top notch service efficiency

MAKES AUTO RADIO REPAIR *twice as easy!*



SERVICING THE MODERN CAR RADIO

by A. L. Hurlbut

2nd Edition, 702 pages, 222 illus. 8½x11, Price $7.50

Used either as a text book or bench manual, Hurlbut's famous SERVICING THE MODERN CAR RADIO is a complete, easily understood guide to fast, accurate installation and servicing of all types of auto radios. Covering every type of auto radio from the mid-'40's, this compact book gives you complete installation, troubleshooting and repair procedures plus tips on how to set up shop and get business. Subjects include differences between car and ordinary radios; antennas; antenna input circuits; power supplies; circuit features; automotive electrical systems; installations; loudspeakers; interference; vibrator maintenance; alignment; push-button tuning and many others. Over 500 actual circuit diagrams and mounting drawings for car radios alone can save you many times the cost of the book.

Includes OVER 500 CAR RADIO CIRCUIT DIAGRAMS and mounting drawings

CUT SERVICE TIME IN ½ *on hundreds of jobs*



RADIO TROUBLESHOOTER'S HANDBOOK

by A. A. Ghirardi

744 Manual-size pages. Over 4800 Radio Models listed. Price $5.00.

This big book makes it easy to make prompt repairs on over 4800 radio models WITHOUT expensive test equipment, or long hours of study. Ghirardi's RADIO TROUBLESHOOTER'S HANDBOOK lists Home and Auto receivers and Automatic Record Changers of 202 manufacturers, together with common trouble-symptoms and exactly where to locate and how to repair the defects. This is not a "study" book. Simply look up the make, model, and trouble-symptom of the set you want to repair and go to work. Ideal for older sets where data is so often lacking. Hundreds of additional pages contain valuable data on tubes, parts and equipment, plus graphs, diagrams and money-making service hints.

a big boost!

Get off the beaten paths! Start training now for the more interesting Radio-TV jobs that most students overlook! Let the following four books teach you at home. Each is complete, fully authentic. Each is endorsed by leading experts and educators in its field.

BE A SOUND EFFECTS EXPERT!

. . . The noise of a creaky door—wind—rain—wagon wheels—and dozens of other sound effects play big parts in almost every radio and TV program. This unique book, RADIO AND TV SOUND EFFECTS tells the whole story of sound effects—even down to showing you how to make crackers, "boing" boxes, glass crashers, splashers, rain machines, thunder machines and much other special equipment for this work. Written by Robert B. Turnbull, of the Don Lee-Mutual Broadcasting System, it is a complete guide to this fascinating phase of Radio-TV work. 334 pages, profusely illustrated. Price $4.50. Order RADIO AND TV SOUND EFFECTS in coupon.

LEARN RADIO-TV ANNOUNCING

. . . Let the big, manual-size RADIO ANNOUNCERS HANDBOOK by Ben G. Henneke help you train for this interesting, well-paid work. Subjects include: The Announcers Qualifications; the Announcers Skills; The Announcers Work; Audition Tests; Vocabulary Exercises—*and over 500 pages of actual radio copy, commercials, newscasts and script shows* for test and practice. More widely used than any other book of its kind. Price $4.75. Use coupon to read RADIO ANNOUNCERS' HANDBOOK for 10 days at OUR RISK.)

FREQUENCY MODULATION

. . . Ever increasing uses for FM in mobile radio, television sound, and home receivers open new fields for profitable service work. Written by a well-known expert, this book simplifies a clear understanding of FM fundamentals, equipment and servicing procedures. You'll learn basic FM theory, transmitters, circuits and their peculiarities, R-F, I-F, limiters, discriminators, ratio-detectors, squelch, AFC circuits, and tuning indicators are fully explained. Equally important is a thorough description of antenna construction, troubleshooting methods, alignment, repair and other servicing procedures. 448 pages, over 300 illustrations. Price $5.00.

LEARN ELECTRIC MOTOR REPAIR

. . . There's big money in installing, maintaining and rewinding electric motors—and here is a big book to help you train for this fast-growing field. Every type of motor work is explained both in text and also by more than 900 helpful drawings, photos and diagrams. ELECTRIC MOTOR REPAIR book includes complete details of troubleshooting, repair and rewinding of all a-c and d-c motor types in common use plus motor control systems. Quick reference guides show how to handle specific jobs. Practice from this book for 10 days at our risk. Order ELECTRIC MOTOR REPAIR in coupon. Price $6.00.

Get this COMPLETE GUIDE TO TELEVISION SERVICE

PRACTICAL TELEVISION SERVICING

by J. R. Johnson & J. H. Newitt

334 pages, 253 illustrations, $4.00



Here—at only a fraction of the price you might expect to pay—is complete, intensely practical training in every phase of television receiver service procedure. You learn how TV differs from radio; how receivers operate; how to locate troubles quickly with a minimum of testing; and how to make repairs fast and profitably. Dozens of actual service case histories help simplify your training, make even the most puzzling jobs far easier to handle. Clear illustrations and pattern photos explain details step by step. Other subjects include component replacement data, wiring details, tips on testing, and a wealth of data on fringe area reception, improving picture linearity and many other vital TV service subjects.

All about TV

Components

Construction

Operation

Trouble-shooting

Servicing—

In language YOU can understand!

THERE'S FUN AND PROFIT *in* Magnetic Recording



MAGNETIC RECORDING

by S. J. Begun

242 pages, 146 illustrations, 6x9, Price $5.00

Get started on the "ground floor" of this fast-growing business that will eventually replace the modern phonograph! MAGNETIC RECORDING brings you specific details on every phase of wire and tape recording from its history, basic acoustic and magnetic theories, through the components, circuits, and equipment in current use. Then, the author describes the many applications of magnetic recording and its use for home entertainment, motion pictures, broadcasting, amateur radio, secret communications (speech scrambling), and the rapidly expanding field of industrial sound and noise measurements. Standard equipment is fully discussed along with the instruments needed to evaluate recording performance.

LEARN NEW USES FOR MAGNETIC RECORDING IN:

High-Fidelity Sound

Broadcasting

Industrial Measurements

Sound Pictures

Home Entertainment

Mail Order—10 DAY EXAMINATION OFFER

Dept. RN-32, RINEHART BOOKS, Inc., Technical Division
232 Madison Ave., New York 16, N. Y.

Send the books checked below for 10-day FREE examination. In 10 days, I will either remit the price indicated or return books postpaid in good condition and owe you nothing.

- ☐ **Ghirardi's Radio & TV Receiver TROUBLESHOOTING & REPAIR, $6.75**
- ☐ **Ghirardi's Radio & TV Receiver CIRCUITRY & OPERATION, $6.00**
- ☐ **COMBINATION OFFER: Both of above new Ghirardi books, $12.00 (Outside U.S.A., $13.00)**
- ☐ **Ghirardi's RADIO PHYSICS COURSE, $3.00**
- ☐ **Modern OSCILLOSCOPES AND THEIR USES, $6.00**
- ☐ **SERVICING THE MODERN CAR RADIO, $7.50**
- ☐ **Ghirardi's RADIO TROUBLESHOOTER'S HANDBOOK, $5.00**
- ☐ **PRACTICAL TELEVISION SERVICING, $4.00**
- ☐ **MAGNETIC RECORDING, $5.00**
- ☐ **FREQUENCY MODULATION, $5.00**
- ☐ **Radio & TV SOUND EFFECTS, $4.50**
- ☐ **RADIO-TV ANNOUNCERS' HANDBOOK, $4.25**
- ☐ **ELECTRIC MOTOR REPAIR, $6.00**

TO ORDER BOOKS OUTSIDE U.S.A.—Add 50c to price of each book for handling through customs, etc. Cash only. Same 10-day return privilege with money refunded.

Name.....

Address.....

City, Zone, State.....

Employers Name and Address.....

STIKIT-UP!

the NEW AMAZING

INDOOR Directronic

TV AERIAL SYSTEM

- ALL CHANNELS
- ANYONE CAN INSTALL
- ADHERES TO ANY SURFACE
- 360° ELECTRONICALLY-SWITCHED BEAM
- FLICK OF SWITCH CLEARS PICTURE

9.95 LIST



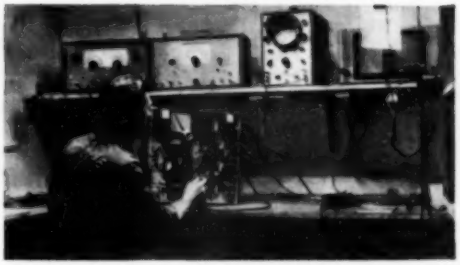
SNYDER MFG. CO. PHILADELPHIA

DALIS, New York • ALMO, Philadelphia • RADIO PARTS, Chicago
FRESHMAN, Cleveland • WHOLESALE RADIO, Baltimore • KAEMPER & BARRETT, San Francisco
VAN DER HOUT, Canada • Export: ROBURN AGENCIES, New York • AND OTHER DISTRIBUTORS, *EVERYWHERE*

HIS PROFITS CLIMBED WHEN HE CUT TV SERVICE COSTS!



"With No Increase In Overhead," says Phil Rudden, "we've tripled our service volume this past year. This progress started when we bought G-E test equipment. In my business, there's no investment that pays off faster."



No Training Problem—When you install G-E units, your technicians need not be intensively schooled in use of the equipment. Easy to operate, these instruments do the work for you. They are fast, accurate, and reliable, and cover both VHF and UHF servicing.

California Dealer Reports G-E Test Equipment Is Big Factor in Lower Bills to Customers, Increased Volume and Higher Net Profit

"A BREAK FOR THE CUSTOMER" is the motto that has helped make Phil Rudden's TV Lab one of the fastest-growing service shops in the San Jose area. By scientifically streamlining his operation, he drives his costs down, keeps customer goodwill by presenting repair bills that are rock bottom.

"Because the best test equipment was our first concern, we've built our whole operation around General Electric units. They shorten the time it takes to do a job, and they pinpoint circuit troubles accurately. Above all, these units are *reliable*."

Your G-E distributor can show you how to improve your TV service business. Why not call him today while the matter is fresh in your mind?



2-in-1 Operation Triples Volume—Any type of chassis servicing, from complex head-end adjustments to locating a faulty resistor in a video IF stage, can be handled by the G-E scopes, markers and sweeps in this twin-bench setup. Work output per man has tripled in one year.





General Electric Co., Section 932
Electronics Park, Syracuse, N.Y.

Rush me your new bulletins on the G-E Test Equipment Package.

NAME.....

ADDRESS.....

CITY.....STATE.....

TV TEST EQUIPMENT THAT COVERS BOTH VHF AND UHF

GENERAL ELECTRIC

AIREX RADIO CORP.

Airex . . . WHERE MERCHANDISE IS TOPS . . .
PRICES ARE LOW . . . VALUES THE GREATEST

Sorry, No Frees • Our Prices Are Too Low • Value Our Specialty

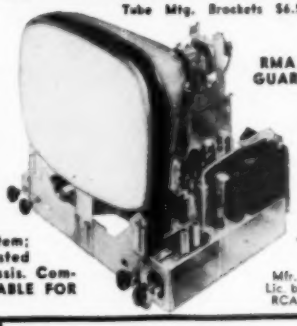
NOW—THE FINEST "630" TV CHASSIS EVER—WITH THE AMAZING CASCODE TUNER

Reception up to 200 miles • 4 microvolt sensitivity

This wonderful new Super DX handles all tubes from 10" to 24" . . . will bring in better reception up to 200 miles without the use of boosters and will work where other sets have failed. The NEW STANDARD COIL CASCODE tuner gives you greater sensitivity with less snow. This tuner utilizes the newly developed 6BK7 tube with the gold-plated grid . . . is fully shielded against radiation and has a newly designed converter circuit. Has new improved Mark flyback with keyed AGC for better picture control; 15 KV output; 3-stage sync separator; 5-hour minimum heat run at factory. Moulded plastic condensers; syncro lock; improved new Ferrite core width coil, for greater range of width. Armstrong FM sound system; improved linearity control. Factory wired, aligned and tested before shipment. Phono connection and switch on chassis. Complete with RCA Hi-Fi 12" Speaker. DIRECTLY ADAPTABLE FOR COLOR AND UHF STATIONS.

$149.95
Complete with Fed. Tax. Less Picture Tube.

Tube Mtg. Brackets $6.50



RMA GUAR.

Mfr. Lic. by RCA

SENSATIONAL SPECIAL OFFER OF THE AIREX SUPER DX COMPLETE TV SETS . . . THE FINEST SET VALUE IN ITS PRICE CLASS

These outstanding sets were specially designed to meet our rigid specifications to assure you many pleasant hours of trouble free TV at an unequalled price. The mfr. is licensed by RCA. RMA guarantee. All you have to do is plug in and play.



17"—$154.95
20"—$179.95

24" TV CONSOLE
1 Year Warrantee on Tubes and Parts **$299.95**



17"—$174.95
20"—$199.95

Check These Features

• Has standard coil Cascode tuner that brings in reception up to 200 miles • 22 tubes • Large Hi-Fi speaker • Hand rubbed, satin finished genuine mahogany cabinet • AGC • Moulded plastic condensers • Black, glareless picture tube, guaranteed for 6 months • Adaptable for UHF and color • Synchronized FM audio system • 5 hour heat run at factory • Factory wired, aligned and tested • Mounted in cabinet.

Price Smashing Values in TV Cabinets for "630" Chassis

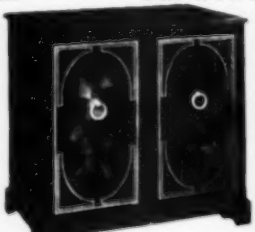
Beautiful, richly finished, hand rubbed mahogany cabinets to suit every taste. They are designed to house the "630" chassis, 12" speaker and up to 20" TV tube. The combination cabinets will hold up to a 20" TV tube, radio and Webster record changer, with ample record space.

All cabinets are equipped with mask and mounting brackets. The perfect chassis deserves a perfect cabinet. It will be a focal point of beauty in your home. Other models in stock. When ordering chassis and cabinet, no tube mounting brackets needed. Send for FREE circular.



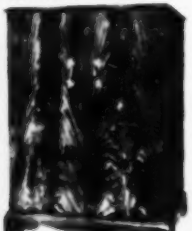
ECONOMY

[illegible]—16" and 17" tube $49.95
41x25x25—16" to 20" tube 59.95
41x25x25—24" tube 74.95
Blonde $10 Additional



ELITE

Combination—39x40x23½. Red antique gen. leather. Gold leaf hand tooling $149.95
In limed oak, gold colored leather 159.95



STRATFORD

40x28½x23½. Genuine scotch Mahogany doors $89.95

All merchandise is brand new, factory fresh & fully guaranteed. Mail & phone orders filled upon receipt of certified check or money order for $25 as deposit on TV chassis, 20% on other items. Balance C.O.D., F.O.B. N. Y. Prices subject to change without notice. No Fed. taxes to pay. Prices lower than OPS Regs.

AIREX RADIO CORP. 171 Washington St., N.Y.C. 7, N.Y. Phone WOrth 2-4029

TV TUBE EXTRA

Standard Brands
BLACK-GLARELESS
Factory New—1st Quality
Guaranteed 1 Year

14" Rectangular	$26.95	17" Rectangular	$32.95
16" Rectangular	29.95	20" Rectangular	39.95
16" Round	33.50	24" Round Metal	69.95

Ring and sleeve for 24" $7.50

ESPEY FM-AM RADIO
12 Tubes Push pull Output **$69.95**

300 OHM TV WIRE
1000 ft. spool **$17.95**
100 ft. spool **$2.00**

AIR KING RADIO CHASSIS
6 tube super-het, AC-DC for custom installation. Complete with loop antenna, tubes and extra RF stage. Reg. $25. **$11.95**
MATCHING CABINET $3.95

Webster "Webcor" Tape Recorder
Portable • Limited Quantity. Regularly $187.50. **$149.50**

RCA HI-FI Speaker $4.95

Airex Special 5-Watt Amplifier
Phono and Mike input, tone control. Complete with tubes, 1—6a5; 1—6SL7; 1—6V6. Reg. $29.95. **$19.95**

"Approved" 10-Watt Amplifier
Hi-fidelity, 50-10,000 CPS. Separate bass and treble boost complete with tubes. 1—5Y3; 2—7F7; 2—7C5. Regularly $69.95. **$34.50**

- Standard Coil Cascode Tuner $24.95
- Super Sonic Booster, MDL107 . . . . . 14.95
- Regency Booster, Mdl DB410 . . . . . 19.11
- TV Masks—16" and 17" $4.95; 20" $7.95; 24" $14.95

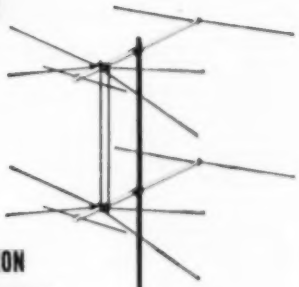
COMPLETE LINE 630 PARTS
RADIO TUBES 40% TO 60% OFF LIST

"NOW YOU CAN FIX YOUR OWN TV SET" Simplified book. Fix over 1,000 models by 30 manufacturers **$1.00**

SEND POSTCARD TO BE PUT ON FREE MAILING LIST



NANTOOK MOOK WALSCO ONKO



(translation)

"BETTER FRINGE AREA RECEPTION WITH WALSCO MODEL M ANTENNA"

There's a magical difference in WALSCO Model M Signal King performance almost *anywhere*. In the fringe areas, or wherever weather is the roughest, the Model M will out-perform, out-last any competitive antenna.

Once you install . . . *that's all*. No costly call-backs that steal your profit. Model M is guaranteed sturdier, more dependable in *any climate*. Chromate-coated magnesium cross-arms have a structural strength almost equal to steel, yet ⅓ lighter than aluminum. Positive corrosion resistance even in severest weather. Elements are made of high-conductivity, super strength aluminum alloy reinforced with Swiss "Permalum." WALSCO Model M is quality you can trust *anywhere*.



WALSCO

Walsco quality earned its reputation

WALTER L. SCHOTT CO.
3225 Exposition Place, Los Angeles 18, Calif
Branch: Chicago 6, Illinois



DEDICATED TO YOU!

This great new *EICO* **FACTORY... these NEWEST *EICO* INSTRUMENTS...** **YOU** made them possible with your **CONFIDENCE** in EICO. We pledge to strive with all our power, product-wise and service-wise, to continue to merit your trust in us.

Harry R. Ashley
President



6 NEW V-O-M KITS and Instruments

FOR LABORATORY PRECISION AT LOWEST COST





EICO New Model 536 — 1000 Ohms-Per-Volt Multimeter KIT $12.90. Wired $14.90.

- 31 1000 ohms/volt full scale ranges!
- DC/AC Volts: Zero to 1, 5, 10, 50, 500, 5000.
- DC/AC Current: 0-1, 10 ma, 0-1, 1 Amp.
- Ohms: 0-500, 100K, 1 meg.
- 6 DB Ranges: −20 to +69.
- Large 3½" 400 ua meter movement.
- High-impact Bakelite case. 6¼ x 3¾ x 2".

EICO New Model 526 1000 Ohms-Per-Volt Multimeter KIT $13.90. Wired $16.90. *As above, with 1% precision resistors.*

ONLY *EICO* GIVES YOU ALL 10 *EICO*NOMICAL FEATURES

• *Laboratory Precision* • *Lowest Cost* • *Lifetime Dependability* • *Speedy Operation* • *Rugged Construction* • *Quality Components* • *Latest Engineering* • *Super-Simplified Assembly & Use Instructions* • *Laboratory-Styled Appearance* • *Exclusive EICO Make-Good Guarantee.*

Compare these value-crammed EICO V-O-Ms with any others at any price—at your local jobber—and SAVE! Write NOW for FREE newest Catalog 3RA — See the photographic proof of EICO's Performance Leadership on the Inside Back Cover of this magazine.

EICO New Model 565 20,000 Ohms-Per-Volt Multimeter KIT $24.95. Wired $29.95.

- 31 full scale ranges!
- DC/AC/Output Volts: 0-2.5, 10, 50, 250, 1000, 5000.
- DC Current: 0-100 ua; 10, 100, 500 ma; 10 Amp.
- Ohms: 0-2000, 200K, 20 meg.
- 5 DB Ranges: −12 to +55.
- Large 4½" 50 ua meter movement.
- High-impact Bakelite case. 6¾ x 5¼ x 3".

EICO New Model 555 20,000 Ohms-Per-Volt Multimeter KIT $29.95. Wired $34.95. *As above with 1% precision resistors.*

EICO New Model 566 1000 Ohms-Per-Volt Multimeter KIT $14.90. Wired $18.95. *Same as Model 536, with 4½" 400 ua meter movement.*

EICO New Model 556 1000 Ohms-Per-Volt Multimeter KIT $16.90. Wired $23.50. *Same as Model 526, with 4½" 400 ua meter movement.*

EICO ©1952

Prices 5% higher on West Coast. Due to unstable conditions, prices and specifications are subject to change without notice.

ELECTRONIC INSTRUMENT CO., Inc. 84 Withers Street, Brooklyn 11, New York

Radio Control On The Citizens Band



Although designed primarily for controlling planes, this unit may be used with ships and other models.

By
VERNON C. MACNABB*

Fig. 1. A little shove and the completely radio-controlled plane is ready to perform.

ANYONE can now control model airplanes and boats by radio. Some readers may wonder why such an obvious statement is made. You always could control anything by radio within certain limits. Control of mobile or distant objects by radio is as old as radio itself, but for the average citizen, a limitation existed in that he had to be a radio amateur, which today means learn the code and pass a technical examination.

In June 1949, the Federal Communications Commission, realizing the necessity for a band of frequencies which would allow the average citizen to operate a transmitter without technical knowledge or ability to read code, opened a band of frequencies known as the Citizens Band, running from 460 to 470 megacycles. This band of frequencies falls somewhere near the indistinct dividing line between what is known as very-high frequencies and ultra-high frequencies. It presents a serious problem in making equipment work on these frequencies because it is close to the limit possible with conventional tubes and tuned circuits and at the same time it is so low in terms of ultra-high frequencies, that short-wave plumbing or waveguides have large and rather unwieldy dimensions. Some recent technical developments, however, have produced some subminiature tubes which will function properly at this frequency so the equipment described in this article is more or less conventional in that it uses tuned circuits instead of cavity resonators.

The photographs, Figs. 4 and 7, show the transmitter and receiver. The transmitter dimensions are 9"x4"x 2¾", and the batteries are self-contained. The weight of the complete unit with batteries installed is less than four (4) pounds. The receiver itself weighs five (5) ounces and the recommended batteries to use with this receiver will weigh an additional nine (9) ounces, making the total weight less than one (1) pound. Dimensions are 3¾"x2⅛".

The accompanying photo (Fig. 1) of a model builder hand-launching a plane illustrates the size airplane that will readily carry this equipment. This plane is powered by a .019 engine. The closeup view of the cabin (Fig. 6) shows the receiver installed in a plane.

The transmitter is a self-excited oscillator with a directly coupled antenna and the problem in designing this unit was one of stability. The circuit diagram, Fig. 2A, looks like any conventional single tube unmodulated transmitter but the chassis, shown outside the case in Fig. 3, shows that mechanically it is a rather radical departure. The tuned circuit and antenna coupling coil is punched out of the chassis for rigidity and grounding reasons. As a result the chassis is connected to "B+." The comb-like piece reduces capacity coupling between the tuned circuit and antenna pickup coil to help pass FCC frequency stability requirements. A piece of bimetal is used to form a small capacity which varies with temperature across the tuned circuit to provide temperature stability. The transmitter had to be approved by the Federal Communications Commission before it could be manufactured, and the requirements were that it should not drift more than 0.4 per-cent from 465 megacycles under a number of conditions, such as tube warm up, decline in battery voltage, and temperature change. It took over eighteen months of development work to satisfy the FCC on these rigid requirements. An individual will find it impractical to try and design a transmitter for his own use as the FCC will not undertake approval tests unless 100 units are to be manufactured.

The folded dipole and reflector which plugs into the top of the transmitter allows the small output of the transmitter to be concentrated in one direction and the reflector also serves the purpose of making the box cold as far as r.f. is concerned. The transmitter operates with 6 volts of filament power and 135 volts of "B" battery. The filament draws 200 milliamperes and the plate current, when the transmitter button is pushed, is 20 milliamperes.

To operate the transmitter, the filament switch is turned to "On" and a minute allowed for tube warm up. A conveniently placed *Micro Switch* is then depressed as the unit is held in the hands to apply "B" voltage and send out the signal.

The function of the receiver is to close a relay when the signal is received from the transmitter. In order to make it suitable for model planes, the weight must be kept to a minimum and one tube is all that is used in the circuit. A superregenerative type of circuit, Fig. 2B, is used which is so sensitive that even when a very weak sig-

* President, Vernon C. MacNabb Company, 915 Westfield Blvd., Indianapolis 20, Ind., manufacturers of "Citizen-Ship" radio control equipment.

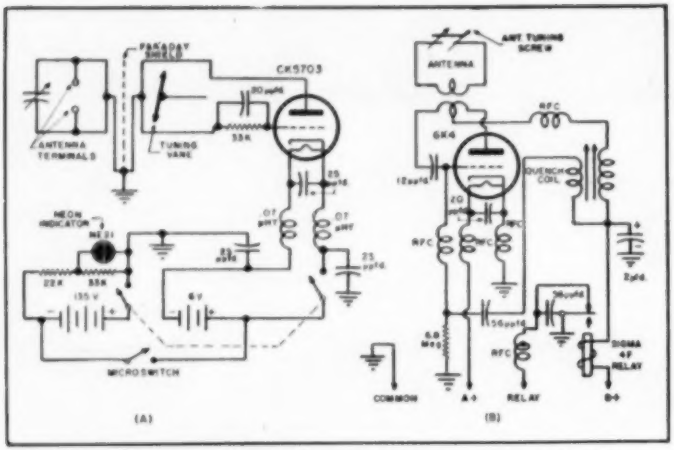


Fig. 2. (A) Complete schematic diagram of the transmitter portion of the radio-control unit. (B) The unusually sensitive superregenerative-type receiver section.

nal is received from the transmitter the plate current change is approximately ten to one. The normal idling current is 0.1 milliampere and when the transmitted signal is received the plate current jumps to 1.0 milliampere, or more. The sensitive relay is set to operate at about 0.3 milliampere therefore it has a large factor of safety and extreme reliability. This action takes place over distances in excess of one-half mile when carried by a plane in the air so that ground reflections and absorptions are not present. At waist heights along the ground, the equipment will work at approximately three-tenths of a mile. Because the plate current is so low, two hearing aid type "B" batteries delivering 60 volts may be used to supply the "B" voltage and their life is as long as their shelf life. The tube in the receiver is a 6K4 subminiature and uses 6 volt filament supply at 150 milliamperes. The intermediate sized flashlight batteries will operate the unit for about an hour.

Looking at the receiver, Fig. 7, it will be noticed that there is a square or rectangular band of aluminum underneath the main chassis base. This is the antenna which is a dipole folded into an approximate square so it is not directional. The tuned circuit is a copper band at the left end of the chassis and the relay is in the right foreground. Four *Fahnestock* clips are provided for connections, "plus A," "plus B," "ground," and the fourth clip for connection to the escapement, motor, or any other device used to control the airplane or boat. The *Fahnestock* clips on the receiver also serve the purpose of mounting the receiver on rubber bands to avoid engine vibration and shock.

Radio control of model planes is not new as they have been flown for approximately fifteen (15) years by such pioneers as Clinton DeSoto and the Good Brothers. The Good Brothers are the most famous for their contributions in this field. One of the simplest means of controlling a model plane in flight is by controlling the rudder only. Most model planes are self-stable, that is, they fly level or return to level flight if disturbed from their normal course without correction of elevators or ailerons. Therefore, all that is necessary to control flight is a rudder, which will cause the plane to turn and return to the operator at will. They are also designed to climb slowly while the motor is running and to glide to earth gently after the motor has run out of gas or is shut off.

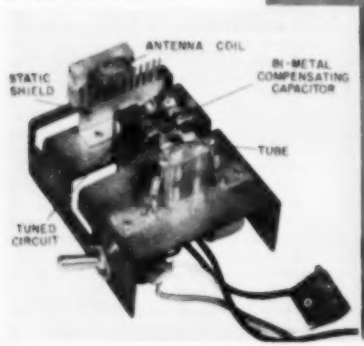
It is surprising the number of maneuvers that can be performed by rudder alone. Not only can all types of turns be executed, such as square patterns, figure eights, etc., but by properly setting the amount of rudder control, the planes can be made to spiral dive and at the end of a spiral dive, by giving opposite rudder, it can be made to loop. The spiral dive, of course, is useful in losing altitude in case the plane is climbing too high under power.

The most common method of obtaining rudder control is by a sequential device known as an escapement as shown in the photograph of Fig. 5. It is a small electromagnetic device weighing only one-half ounce, which is driven by a rubber band and triggered by the closing of the relay in the receiver. The escapement moves the rudder from neutral to right, back to neutral, to left, always returning to neutral when the transmitter is off. If right rudder has just been used and the rudder is back to neutral, one pulse

Fig. 4. Over-all view of transmitter with antenna. The entire radio-control unit weighs less than four lbs. including batteries. →



Fig. 3. Transmitter removed from case and showing the unusual way that the unit is constructed.



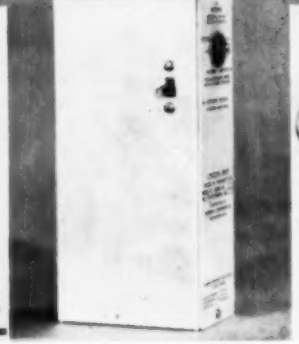
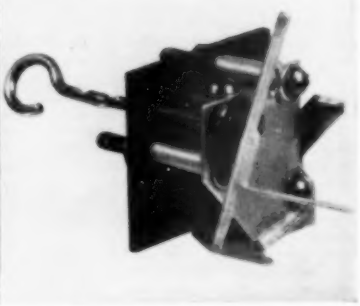


Fig. 5. The most common method of obtaining rudder control. This sequential device, known as an "escapement," moves rudder left, neutral, right.



gives left rudder, two pulses right rudder.

The work of the Good Brothers and early experimenters was done in the 5 meter ham band. The receiver was a superregenerative set which normally drew about 1.5 milliamperes. This plate current dropped to about half that value when the signal was sent to it. It was necessary, therefore, to cause a relay to function within a two-to-one change of plate current. There was another limitation; with this constant "B" battery drain, as the plate voltage fell the plate current itself declined and the relay setting might have to be changed.

Strangely enough, in spite of all the difficulties encountered in making the system operate at 465 megacycles in the Citizens Band, one advantage is outstanding. Because of the extremely high radio frequency in comparison to the low audio frequency in the conventional superregenerative circuits, the plate current increases instead of decreases, and because of the large safety factor on plate current change as mentioned before, decline in "B" voltage does not cause marginal operation of the relay. In addition, because the current is low with no transmitted signal, economy of "B" power is obtained which obviously saves weight.

Further convenience contributed by the 465 megacycles is the small dimensions of the half-wave dipole that makes the transmitter completely portable. It is only one foot long. The transmitters working on 54 megacycles require the erection of an approximate 8 foot dipole which anchors the operator to one spot.

The best example of the reliability of this equipment, which is commercially called "Citizen-Ship Radio Control," is the fact that the first production units to leave the factory were used in competition at the National Model Airplane Meet in Dallas, Texas, in July 1950, and the model builder who incorporated this equipment in his ship won first place. It is obvious that the radio alone was not the sole reason for winning, but without equipment that was absolutely reliable, it would have been impossible. Never once did the radio system fail to respond when the transmitter was actuated. There were many cases of other contestants, some of whom had home-made equipment and on the ham band, who would lose control of their planes and they would fly away, resulting in not only loss of points, but sometimes a damaged plane when recovered.

"Citizen-Ship Radio Control" equipment is virtually license-free, as no examination or code test is required. A federal form is packed with each transmitter and it is only necessary for the purchaser to fill out this form and send it to his nearest FCC Field Engineering Office and a portion of the form is stamped with a number and returned to the purchaser. This becomes the radio transmitter's license. With this license, anyone can use the transmitter. The only limitation is that any individual less than 18 years old cannot obtain a license, but it is permissible for him to use the equipment if one of his parents obtains the license.



Fig. 6. Close-up view of the cabin showing the receiver installed in the plane.

This virtually license-free equipment opens up a new field to hobbyists. The equipment is designed, engineered, and manufactured so that no knowledge of radio is required to use it. If a person is capable of connecting up a simple electrical circuit, which means connecting up the batteries, the equipment is guaranteed to operate. With this equipment in the hands of ingenious hobbyists and model builders, it may soon be possible to control a model plane in as complex a manner as though a pilot were in the plane itself. One manufacturer already has a device which requires a very simple accessory to the transmitter and in place of the escapement a selective mechanism in the plane attached to the receiver, which will give as many as twenty-four (24) different functions. With this number of controls, anything is possible. The air over vacant lots may soon be filled with model planes zooming over the heads of spellbound spectators.

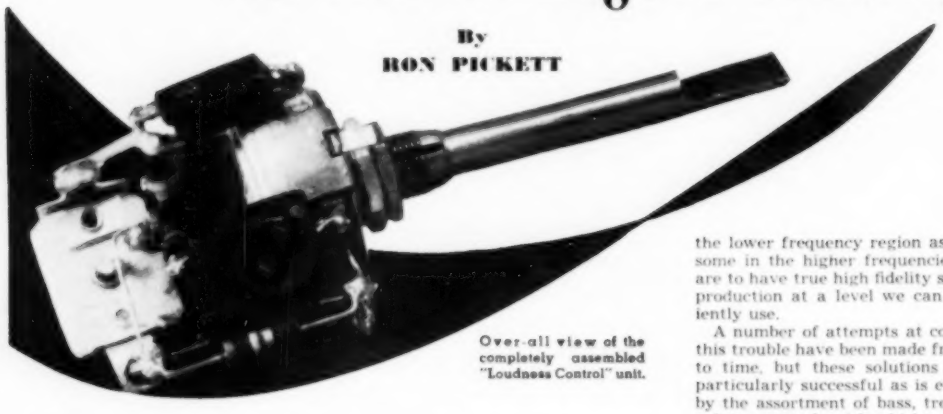
Editor's Note: The home construction of the transmitter described is not advisable, as FCC approval cannot be obtained for such units. —30—

Fig. 7. Receiver section with the dipole antenna folded into a non-directional square.



THE LOUDNESS CONTROL— An Aid To Higher Fidelity

By
RON PICKETT



Over-all view of the completely assembled "Loudness Control" unit.

Although quite often overlooked, compensation for the frequency characteristic of the human ear is a very important factor in better quality audio.

ONE of the factors in the design of high quality audio equipment which is all too often neglected is the frequency response characteristic of the human ear. We take great pains to see that our sound equipment is capable of flat response throughout the audible range, and that harmonic and intermodulation distortion are within reason, yet we pay little or no heed to the manner in which the ear responds to various frequencies.

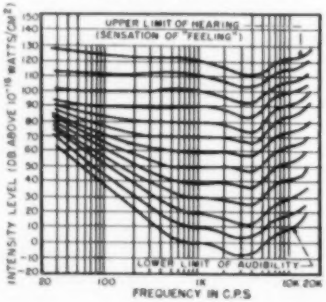
The work of H. Fletcher and W. A. Munson[1] should be familiar to all audio designers, but unfortunately, little emphasis appears to have been placed on the importance of their findings.

Fig. 1 shows some of their findings, in graphical form. These curves were prepared from averaged measurements taken with a large number of individuals, and each curve represents the intensity of a pure tone judged by the individual to be the same intensity as a pure tone of 1000 cycles, the reference frequency. The curves, then, show the remarkable inability of the human ear to respond to all frequencies alike. For example, a pure tone of 1000 cycles, produced at a level of 20 db sounds as loud as a pure tone of 100 cycles produced with 30 db greater intensity.

It is easy to see why our sound equipment is unsatisfactory at low levels, appearing to lose bass response, and to a lesser degree, the high frequency response also suffers. In spite of the fact that an uncompensated amplifier and speaker system may be measured to show a uniform response from 20 to 20,000 cycles at any level, it will sound good only when reproducing at a level comparable to that of the original source. For example, a full symphony orchestra may require as much as 50 to 60 watts, and it is doubtful if many of our wives (or neighbors, for that matter) would permit us to use an acoustical power output of this magnitude for very long. But if, with an ordinary volume control, we reproduce the orchestra at the much more comfortable level of 50 to 60 milliwatts, then the loss of bass response is so apparent to our ears that the quality suffers greatly. We are thus torn between the desires of keeping the naturalness in our musical reproduction and keeping the neighborhood peace.

A little study of the curves of Fig. 1 will show that our audio equipment, particularly that used in the home, requires a great deal of compensation in the lower frequency region as well as some in the higher frequencies, if we are to have true high fidelity sound reproduction at a level we can conveniently use.

Fig. 1. The Fletcher-Munson curves.



A number of attempts at correcting this trouble have been made from time to time, but these solutions are not particularly successful as is evidenced by the assortment of bass, treble, and volume controls with which our equipment is customarily burdened. The shunt condenser type of tone control and the tapped volume control, both shown in Fig. 2 are, of course, steps in the right direction, but their effectiveness is necessarily limited. The complexity to which bass and treble compensation controls can grow is easily seen in modern audio circuitry.

Recently, a number of compensated volume controls have appeared[2,3,4] which offer advantages not previously obtainable. These are called "Loudness Controls" because they closely approach the compensation required to match the equal loudness curves shown in Fig. 1, at least in the low frequency region. Thus, the bass compensation and volume controls are combined.

In practice, however, all these controls suffer from one or more of the following defects which contribute to something less than enjoyable listening.

First, two of the three "Loudness Controls" described use switch or step-type attenuators, which are confusing to the average user, since most of us are not accustomed to handling this type of control. Second, none of the three provide any high frequency compensation, even though the Fletcher-Munson curves indicate the need for this, especially at the lower intensity levels. Third, none of the controls provide a sufficient range of attenuation so that they can replace an existing volume control directly, thus making necessary an additional control for level-setting, from which the "Loudness Control" operates.

The validity of the last point may be debatable, but most will agree that additional controls are undesirable. The range of attenuation required is dictated by both the maximum output

of the equipment in use, say 10 to 15 watts, and the minimum usable output for a comfortable background of music. The minimum usable output then determines the range of attenuation required. Some studies have shown that average residences have a sound intensity level of about 40 db above the threshold of hearing, which is the 0 db curve in Fig. 1 for normal ears. If we are to match the maximum average power output of a large orchestra at the high end of our attenuation range, say 100 db on the same scale, then 60 db total attenuation is required in a "Loudness Control" to reduce the orchestra to a level corresponding to the background which is present in our homes.

In the "Loudness Control" to be described, an attempt is made to overcome the faults of its predecessors as outlined before. Fig. 3 is the schematic of the unit, together with the values of the components used. Fig. 5 shows the performance characteristics, as measured with laboratory equipment. It can be seen that a total of 60 db attenuation is provided at 1000 cycles, while both high and low frequencies are compensated as necessary to give natural reproduction at any level.

Calculation of the values of the components in a network such as this is tedious, but can be considerably simplified by a few practical assumptions. If we consider the output of our control to be unloaded, as it is when feeding a class A grid, and further if we choose values such that each section of the complete control will not appreciably load the preceding section, it is then possible to consider each section separately.

Fig. 4 shows one section of the "Loudness Control" alone. Since there are five such sections in the complete control, a total of 60 db attenuation at 1000 cycles means that each section must contribute 12 db at this frequency. The curves of Fig. 1 show that 9 db attenuation is required in the first section at 100 cycles when we have 12 db at 1000 cycles. These attenuations correspond to voltage ratios of 2.8 and 4.0 respectively.

It can be shown, then, that in Fig. 4,

$$4.0 = \frac{\sqrt{(200K + R)^2 + X^2}}{\sqrt{R^2 + X^2}}$$

at 1000 cycles

and

$$2.8 = \frac{\sqrt{(200K + R)^2 + 100X^2}}{\sqrt{R^2 + 100X^2}}$$

at 100 cycles.

Solving these as simultaneous equations gives the values of X and R for the first section. Similarly, X and R for each succeeding section can be found, considering the additional attenuation required in each section at 100 cycles for the 12 db steps at 1000 cycles. The capacitance value is, of course, computed from the relation $X = 1/2\pi fC$.

The high frequency compensating condenser, C_1, in Fig. 3, should be chosen so that it represents a higher reactance at 1000 cycles than the portion of the potentiometer across which it is connected, but compares with or is nearly equal to the resistance at 10,000 cycles. A 3-30 $\mu\mu$fd. trimmer is adequate here, and allows enough adjustment so that the effect of stray wiring capacitance can be eliminated.

The component values, as given in Fig. 3, yield an effective input impedance for the "Loudness Control" of about 250,000 ohms, and it may therefore be used as a direct replacement for any existing grid circuit volume control whose total resistance is between 100,000 ohms and one megohm. The output of the "Loudness Control" is intended to feed the extremely high impedance we find at the grid of a class A amplifier, and the purpose of the one megohm resistor R_1 is to complete the grid circuit to ground. It would not be advisable to attempt to feed a transformer from the output of the "Loudness Control," because the reactance of the transformer is likely to upset the attenuation characteristics.

Mechanically, this "Loudness Control" is built around a standard linear taper *Ohmite* or *Allen-Bradley* potentiometer which has been modified in much the same way as one of the previously described units[1]. This type of potentiometer was chosen because of the sturdy mechanical characteristics of its resistance element. It is necessary to provide four taps on the control. These were made in the following manner. Four holes were drilled into the side of the potentiometer base at convenient points. These holes should be just large enough so that a piece of solid tinned hook-up wire can be inserted to fit snugly. The depth

(*Continued on page* 161)

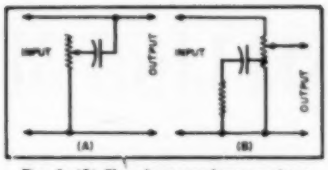


Fig. 2. (A) The shunt condenser-resistor type tone control and (B) the tapped volume control. Their effectiveness in obtaining correct compensation is limited.

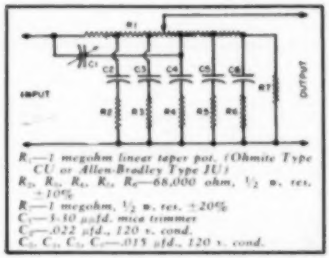


Fig. 3. Wiring diagram of "Loudness Control."

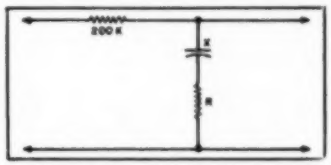
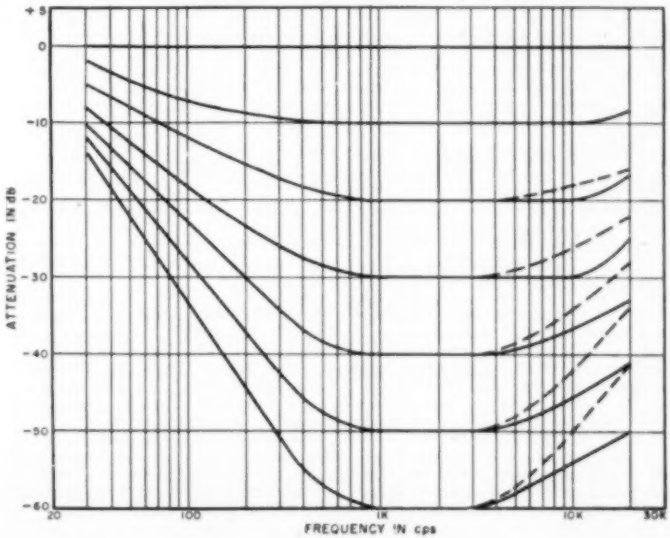


Fig. 4. One section of the "Loudness Control."

Fig. 5. Measured response curves. The solid lines indicate the high frequency compensation obtained with the variable trimmer condenser set at minimum and the dashed lines the compensation with the condenser at maximum. As mentioned in text, stray capacitance between input and output leads produced by wiring the "Loudness Control" into an amplifier will give rise to additional high frequency compensation.



SELLING MAINTENANCE- and YOURSELF



Technical "know-how" is important but don't forget those vital "extras."

By
YVON O. JOHNSON

Your livelihood depends as much on pleasing your customers as your ability to repair sets properly.

YOU may be so wrapped up in the technical aspects of radio and TV servicing that you may not realize that you are actually selling two things: maintenance and, more important, yourself.

Selling yourself implies that you are able to get along well with your customers; it means that you create a good impression for yourself and your firm; it means that customers think that you are the only one who will ever fix their sets.

You can be one of the best radio and TV troubleshooters in town but you can get into more trouble if you rub your customers the wrong way. You can make your day more pleasant and profitable by observing a few rules that are almost as important as circuit diagrams in servicing TV and radio for a living. Don't neglect your technical ability, however.

The technician who handles customers in a salesman-like way will find himself considered a valuable asset to his company; often, a firm will be willing to pay premium wages for his services. Conversely, a company will soon lose patience with a man who creates more trouble than he solves on a service call.

Technicians often bemoan the lack of confidence that the general public has in the service industry. While this situation is to be deplored and combated by every member of the industry, you will find that it can help you instead of hinder you! Here's how it works to your advantage: When a customer finds that you are thoroughly honest and competent he will come back again and will recommend you to his friends because he knows that you are trustworthy and he doesn't know that the next technician will be equally trustworthy.

A Good Impression

You are no more than your customer's impression of you. He has no meter to measure your ability to fix his set. He know only what he thinks of you. You may be tops in servicing ability but he may not think so; you may be average, but he may think you are the best. This occurs because of the fact that customers usually have no understanding of the work involved in diagnosing and repairing a set.

Your customer wants you to be honest, truthful, efficient, and competent. Your first step is to *be* these things. Your next step is to let the customer see these characteristics for himself. That is your problem. Here are some suggestions to help you solve that problem for yourself.

Be on time. You'll start off on the wrong foot if you are late for the service call. Phone the customer in advance if you know that you will be late. This may seem to be rather obvious to you, but customers will tell you of other technicians who failed to show up at all on the day of the scheduled call.

Be courteous. Courtesy begins when the customer opens the door. Have a friendly greeting announcing your firm's name. The customer will then ask you to come inside. By all means, say: "Thank you." Already the customer will think of you as a very nice person.

You should remain courteous through the entire call regardless of what the customer says that might irritate you; be above giving sharp replies. Of course, you should thank the customer pleasantly when you leave.

Be neat in appearance. Your appearance must coincide with the idea that the average customer has of a competent technician. That is, look the part and you will be playing it in the customer's mind.

What would you, if you were a customer, expect a technician to look like? Probably you'll come up with an answer like this: hair cut and combed, clean shaven, and dressed in clean work clothing. You should neither look as if you have just crawled out from beneath your car nor as if you are going out on a heavy date. You don't want to be sloppily dressed, yet you should look as if you aren't afraid of a little hard work.

Carry professional equipment. If you carry professional-looking equipment, you will have the look of a thoroughly competent technician. Tools in good shape and an attractive case in which to carry them will make the customer think well of you.

You may be pleasantly surprised to realize that the quality of your tools will impress two widely separated groups of customers: the man who works at a trade and the housewife. The man who has tools of his own that he uses in his daily work will look with a critical eye at your own collection of tools. They had better pass his inspection; if they do, he'll consider you a master craftsman like himself.

You will receive a lot of favorable

comment from housewives over attractive rolls of screwdrivers and socket wrenches. If you carry a mirror which is adjustable on a stand you'll appear to be one of the best equipped technicians who ever worked on the set. The customer may not say it, but he thinks that you have his best interests at heart when you come properly equipped.

Act decisively. Almost any TV owner can tell you about a technician who looked at the set, scratched his head and said, "I've never seen this make of set before." That technician, certainly, did not act decisively.

You should have a definite approach to the set. As you switch the set on, ask the customer: "What has it been doing?" Don't say: "What's wrong with the set?" That'll get you: "You tell me!"

Try all front controls briefly. Next, remove vases and figurines from the top of the set before you try to move it. If you don't, an accident may happen. It is wise to let the customer remove these things if he volunteers to do so. It's also best to place the indoor antenna control box on the floor out of the way. This will save getting your feet tangled in the cables and causing the unit to crash to the floor.

If possible, fold back a small part of the rug so that you can swing the set around to work inside of it. Beware of a table model TV set on a table with thin, unbraced legs. The legs will sometimes snap off if you push the set and table when the legs are on a rug. It helps to lift up slightly at the same time that you move the set.

Place your mirror in front of the TV set, remove the back of the cabinet and you are ready for work. If it turns out to be tube trouble only, don't just stick in a new tube and then run out of the house. Adjust the rear controls for a linear picture of the correct size. The customer will appreciate it. If you have removed the chassis for some reason, buff the tuner contacts with a clean, dry cloth if the tuner was a bit noisy. Wipe the inside of the cabinet's glass and clean the picture tube.

Regardless of how much or how little you do, follow a regular routine and act as if you know what you are doing. The customer will appreciate the professional way that you go about your business.

End up by leaving the old tubes and the cartons from the new ones. This helps to show your honesty to the customer.

Be neat. A good rule is to leave the customer's home as neat as you found it. Better yet, be neat as you work so that the customer does not worry about having to clean up after you have left.

Neatness as you work saves you time and money. You save time by not having to waste it cleaning up after yourself. You save money by always replacing tools in their proper places in the tool kit as you finish using each one, rather than trying to find all the tools when it is time to leave.

Choose words carefully. Every word that you say to the customer about his set and antenna will be remembered by him. It will be quoted by him, correctly or incorrectly, to your company in case of future difficulties. Customers are prone to read meanings into your words that you did not intend. Be careful and choosy in what you say. It is generally best to say as little as possible until you know the entire history of the set and of the customer's relations with your firm. Don't make commitments for your company unless you are specifically authorized to do so. If the customer wants something done that you are not certain about, it is usually best to say: "I have no authority concerning that, but I'll be glad to speak to the manager when I get back to the shop and have him call you." This gives you and the manager a chance to get in a huddle over the matter.

In connection with using the proper words, be very careful not to criticize his set. You may not like it, but he does.

Maintenance vs. Service

If you have succeeded in selling yourself by creating a good impression and getting along well with the customer, your next step is to sell maintenance. Here are some suggestions.

Talk maintenance. A customer usually wants to know how long his TV set will run until it needs repairs again. Don't make promises that will bounce back on you. It's much better to honestly say: "We've corrected all the troubles that have shown up while we've had it in the shop. It's impossible to tell when a case of trouble might occur again. All your tubes are working fine right now. I can't predict which will be the next one to go out. But you will have, on the average, 3 or 4 of the small tubes go out each year. That isn't trouble or repairs; it's just normal maintenance."

Be sure to get the point across that tube replacements are to be expected and that they are no reflection on the quality of the set. Building up the idea of tube replacements as maintenance instead of service trouble helps you in many ways: you are not criticized when you are called in to replace one tube after another; the customer expects to see you several times a year; you become a permanent fixture in the maintenance of his TV.

Today's family budgets are relatively inelastic and television servicing and maintenance must, of necessity, compete with fixed living costs like food, rent, clothing, etc.

Tactfully handled, the subject of television maintenance can be sold as an "essential" part of the family's entertainment budget.

Tell your story completely but don't over-sell as there may be financial difficulties facing the customer about which you can have no inkling. If you can sell the *idea*, you'll get the business when and if the family can afford it.

Point out troubles. Sometimes it is necessary to leave a set with some troubles in it other than the trouble you corrected. The customer may want to wait until later to have the additional work done. To protect yourself, make a note on all copies of the work tag of the fact that the set needs to go into the shop to have the additional trouble corrected. The desirable customer will appreciate your telling him of the condition of his set. This note will keep the undesirable customer from telephoning the shop the next day to say that his set has developed some new troubles because of the work you did on it.

You'll find that you will usually get the job of correcting the additional trouble as soon as the customer is able to pay for it.

How Are You Doing?

Did you check the statements in the box below before you read this article? If you didn't, it will be worth your while to do so. These statements with your checkmarks will help to indicate to you that you may need to work a little more effectively on selling both maintenance and yourself to the public.

The best answers as to how you are doing actually come from the customers themselves. If you find that they ask for your name when you leave, if they request you when they phone the shop to place a service call, and if they give you a friendly reception when you come in the door, then you know that you are doing an effective job of selling yourself. —30—

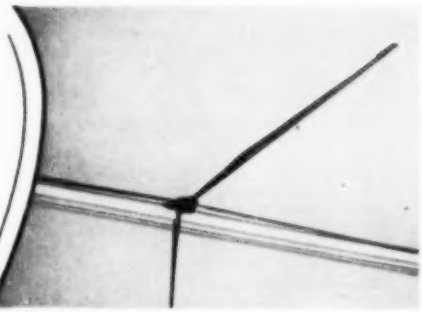
HOW ARE YOU GETTING ALONG WITH CUSTOMERS?

Place a check mark under the appropriate frequency column opposite each statement.

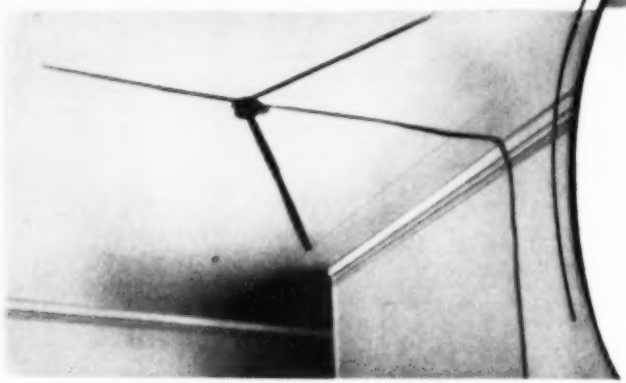
	Often	Sometimes	Never
Customers don't recognize your ability	☐	☐	☐
Customers don't thank you when you leave	☐	☐	☐
You aren't dressed as neatly as you should be	☐	☐	☐
You carry all your tools in your pocket	☐	☐	☐
You tell customers you haven't worked on that brand of set before	☐	☐	☐
You spread your tools all over the floor	☐	☐	☐
Customers accuse you of saying things you did not mean	☐	☐	☐
Customers think it is your fault when a tube burns out	☐	☐	☐

If you have all "Never's" you probably haven't been out on a service call in months; a column of checks under "Sometimes" indicates that you could do a little constructive work on yourself; several "Often's" may mean that you need to put forth some effort to sell yourself before your income suffers.

Problems of INDOOR ANTENNA RECEPTION



An alternative ceiling type mount.



Ceiling mounting position for antenna. Elements are spaced 120° apart.

By

E. M. NOLL and M. MANDL

Simple switching unit permits omni-directional reception without rotating the antenna.

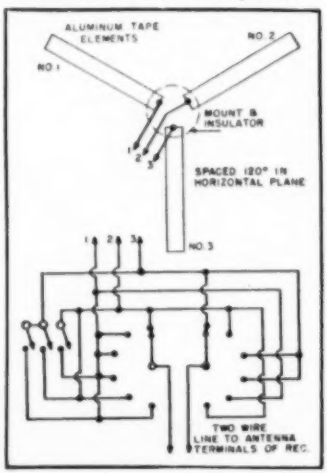
THE conventional indoor television antenna is economical and is convenient only to the extent that no outdoor antenna need be erected. However, its electrical performance and operating characteristics are, in general, *much* poorer than a proper outdoor type. An indoor antenna system is afflicted with numerous defects and problems—orientation, smear, reflections, weak signals, noise, signal interference, and instability. These inconveniences and defects mean picture quality, clarity, and stability are compromised on some and perhaps all channels. Nevertheless, there are many metropolitan and suburban sites such as hotels, apartments, and special housing projects where outdoor antennas are not convenient or are prohibited. Even in residential areas it would be nice to be able to dispense with the unsightly outdoor antenna. A convenient and effective indoor antenna would be a significant contribution to improved reception for many TV homes.

Orientation

Antenna orientation has always been a major indoor antenna problem and nuisance. The indoor "rabbit-ear" is versatile in this respect because it can be oriented and its length adjusted. However, to obtain optimum performance on each channel with stations in different directions, it is necessary to readjust orientation when switching channels. Even with stations in the same direction from a given site, the presence of multiple indoor reflections and multiple high-band lobes often requires orientation from channel to channel if peak performance is to be obtained.

Improper orientation can cause picture smear, sync instability, and ghosts. When an indoor antenna is oriented away from true direction, the picture first begins to smear (presence of weaker direct signal and slightly delayed reflections). As orientation is continued in the same direction, the picture becomes weaker and sync stability poorer (reflected signals have more influence on sync system). Finally, a number of pictures are seen on a very shaky raster (indicating multiple signal reception with sync control shifting between the now much weaker direct signal and reflected components).

Fig. 1. An indoor "Directronic" type antenna with aluminum tape adhesive elements and circuit of switching device.



Reflections

Indoor multiple reflections cause three types of picture disturbance. When the preponderance of reflected signals arrive at the antenna just slightly displaced in time with respect to the direct signal (time delay comparable to partial period of r.f. cycle) the resultant signal delivered to the receiver input can be additive or subtractive as a function of phase relations between r.f. cycles of reflected and direct signal. Consequently, as the antenna is moved about the room there are definite points of strong and weak picture for each channel. It is quite difficult to locate one spot where peak performance is obtained on each channel.

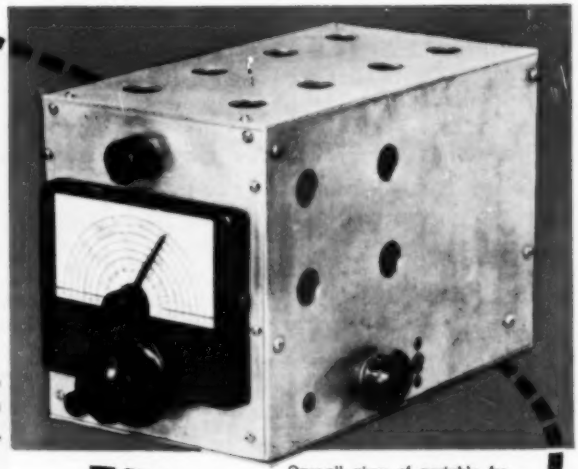
In the case of a built-in antenna or indoor antenna with just a few feet of line between it and the receiver, it means the receiver has to be moved to

(*Continued on page* 111)

A MIDGET V.F.O.

By
W. W. PURVIS, W3QQA

Covers 20, 40, 80 meters, is compact, and features clickless, chirpless keying and narrow-band FM phone.



Over-all view of variable frequency exciter unit. In addition to fixed station use, it is suitable for many mobile applications.

IN VIEW of the difficulties involved in building extremely small variable frequency exciters with good inherent stability, most designers of amateur portable or miniature sized radio transmitters have employed crystal control and the equipment was, therefore, limited to single or fixed frequency operation. Crystal controlled carriers are of course rendered practically useless at times, due to the crowded conditions on the ham bands. Every amateur radio operator recognizes the variable frequency oscillator as an essential part of the modern ham station, for the purpose of shifting the transmitter carrier away from interfering signals and into clear channels. The v.f.o. is also used for spotting DX; in other words for shifting the carrier so as to zero-beat it with the incoming signal of the distant station. The latter method of signal spotting is also used for local contacts, as practically all hams are now in the habit of tuning their receivers so as to hear only those stations calling on the exact frequency to which their transmitters are tuned.

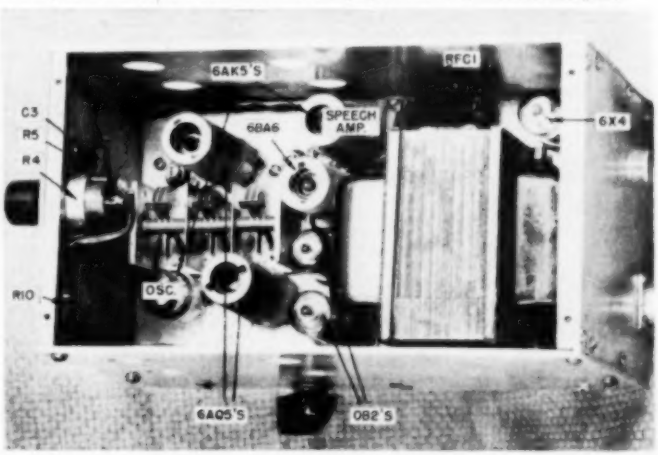
In designing the v.f.o. herein described, the writer has solved some of the problems relative to building midget sized equipment. Approaching the handie-talkie in size, this unit incorporates slightly new and different methods of construction and it is hoped that these methods will prove helpful to amateurs desiring to build equipment perhaps even smaller than that shown here.

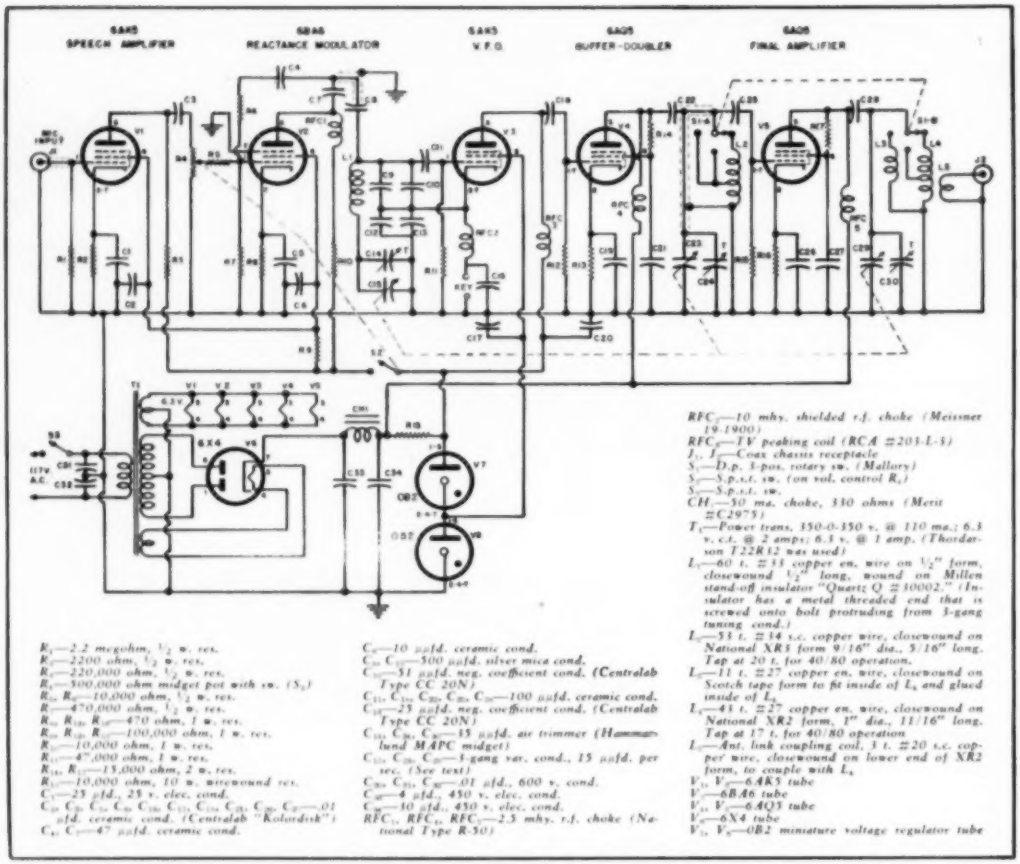
A good compact unit, with regulated power supply, this v.f.o. operates well on three bands. It is a complete exciter/transmitter and is a handy unit for those who want to transport their equipment from place to place. The unit operates on 20, 40, and 80 meters (the old reliable bands where DX is ever-present), and will drive the necessary frequency multipliers, making it possible to double to almost any other amateur frequency.

Unique in design, this unit uses a 3-gang receiving type of midget tuning condenser. Without regard for certain established methods of construction, this set has a power output on the three bands comparable to that obtained with almost any other type of design. The cabinet measures only 5¾" high, 4⅝" wide, and 8½" long and the entire set weighs 11¼ pounds, including the eight miniature type tubes. Should another type of power supply be employed and if the power transformer is replaced by selenium rectifier voltage doublers, a considerable reduction in the size of this unit would be possible. The entire transmitter/exciter minus the power supply would measure only one-half of its present length, or 4¼ inches.

Contrary to the general practice of spacing the stages far apart to avoid interaction or feedback, this exciter's stages are jammed as closely together as possible. The r.f. feedback is eliminated entirely by shielding the lead from the tuning condenser C_{3b} (Figs. 1 and 2), throughout its entire length, from the stator side of C_{3b} to the switch S_{1A}. Also of importance is the method of supplying the screens of the 6AQ5's

Top view with cover removed to show the proper location of above-chassis parts.





R_1—2.2 megohm, 1/2 w. res.
R_2—2200 ohm, 1/2 w. res.
R_3—220,000 ohm, 1/2 w. res.
R_4—500,000 ohm midget pot with sw. (S_3)
R_5, R_6—10,000 ohm, 1/2 w. res.
R_7—470,000 ohm, 1/2 w. res.
R_8, R_{10}, R_{17}—470 ohm, 1 w. res.
R_9, R_{12}—100,000 ohm, 1 w. res.
R_{11}—10,000 ohm, 1 w. res.
R_{13}—47,000 ohm, 1 w. res.
R_{14}, R_{15}—15,000 ohm, 2 w. res.
R_{16}—10,000 ohm, 10 w. wirewound res.
C_1—25 μfd., 25 v. elec. cond.
C_2, C_3, C_{13}, C_{19}, C_{28}, C_{31}, C_{32}, C_{33}, C_{39}, C_{40}—.01 μfd. ceramic cond. (Centralab "Rolordisk")
C_4, C_{27}—47 μμfd. ceramic cond.
C_5—10 μμfd. ceramic cond.
C_6, C_{17}—500 μμfd. silver mica cond.
C_{10}—51 μμfd. neg. coefficient cond. (Centralab Type CC 20N)
C_{11}, C_{12}, C_{20}, C_{21}, C_{29}—100 μμfd. ceramic cond.
C_{14}—25 μμfd. neg. coefficient cond. (Centralab Type CC 20N)
C_{15}, C_{16}, C_{22}—15 μμfd. air trimmer (Hammarlund MAPC midget)
C_{23}, C_{24}, C_{25}—3-gang var. cond., 15 μμfd. per sec. (See text)
C_{26}, C_{35}, C_{36}—.01 μfd., 600 v. cond.
C_{37}—4 μfd., 450 v. elec. cond.
C_{38}—10 μfd., 450 v. elec. cond.
RFC_1, RFC_2, RFC_3—2.5 mhy. r.f. choke (National Type R-50)
RFC_4—10 mhy. shielded r.f. choke (Meissner 19-1900)
RFC_5—IV peaking coil (RCA #203-L-3)
J_1, J_2—Coax chassis receptacle
S_1—D.p. 3-pos. rotary sw. (Mallory)
S_2—S.p.s.t. sw. (on vol. control R_4)
S_3—S.p.s.t. sw.
CH_1—50 ma. choke, 330 ohms (Merit #C2975)
T_1—Power trans. 350-0-350 v. @ 110 ma.; 6.3 v. c.t. @ 2 amps; 6.3 v. @ 1 amp. (Thordarson T22R12 was used)
L_1—60 t. #33 copper en. wire on 1/2" form, closewound 1/2" long, wound on Millen stand-off insulator "Quartz Q #30002." (Insulator has a metal threaded end that is screwed onto bolt protruding from 3-gang tuning cond.)
L_2—54 t. #14 s.c. copper wire, closewound on National XR3 form 9/16" dia., 3/16" long. Tap at 20 t. for 40/80 operation.
L_3—11 t. #27 copper en. wire, closewound on Scotch tape form to fit inside of L_4 and glued inside of L_4.
L_4—45 t. #27 copper en. wire, closewound on National XR2 form, 1" dia., 11/16" long. Tap at 17 t. for 40/80 operation.
L_5—Ant. link coupling coil, 3 t. #20 s.c. copper wire, closewound on lower end of XR2 form, to couple with L_4
V_1, V_2—6AK5 tube
V_3—6BA6 tube
V_4, V_5—6AQ5 tube
V_6—6X4 tube
V_7, V_8—0B2 miniature voltage regulator tube

Fig. 1. Schematic diagram of the variable frequency exciter. The circuit is straightforward and easy to duplicate.

directly from the tube plates through the 15,000 ohm, 2 watt resistors, R_{14} and R_{15}.

This v.f.o., when keyed, transmits a signal of excellent quality. Many radio amateurs have reported its signals to be the best quality heard on the air. Every *critical* report on its reception claims the signals sound crystal controlled.

After more than a year and a half of daily operation this unit continues to be trouble free, transmitting very stable, clickless and chirpless signals. The frequency modulated signals are also exceptionally good. This exciter performs in a smaller space and on more frequencies than other amateur v.f.o.'s seen heretofore.

No television interference has been encountered, even when this exciter is operated right on the top of a TV receiver. At several locations, this unit is used by the writer to drive 2E25 and/or 2E26 type tubes which, in turn, drive the output stages of medium powered transmitters. Over two hundred watts input is used at these locations with class B modulation, without TVI. The narrow band FM works well, but AM causes no TVI and is used in preference.

The output of the 6AQ5 final stage on 40 and 80 meters is sufficient to light a seven watt lamp brightly and on 20 meters the seven watt lamp shows slightly less brilliance. With a half-wave dipole antenna indoors, operating on 40 meters, very good results were obtained while using this unit solo, and on 20, employing a flat-top beam, distances up to 3600 miles were worked with little difficulty.

Although it may appear that feeding the screens as described would cause the 6AQ5's to operate as triodes, this is not the case because resistors R_{14} and R_{15} act as r.f. chokes. The screens of these tubes are bypassed to ground through condensers C_{39} and C_{40}. Fig. 2 shows the chassis layout with reference to the d.c. plate and screen leads to the tubes.

A tuning condenser of the type used in the old FM broadcast tuners with 15 μμfd. per gang section and with 3 rotor and 2 stator plates per section is employed. A condenser of this type can be obtained from *All Star Products Inc.*, Defiance, Ohio.

An electro-zinc plated, open-ended chassis measuring 4 1/2" by 7 3/4" by 1 1/2" is used. The steatite tube sockets, shielded type, are riveted to the chassis and all grounds connected to the socket center posts which are, in turn, grounded to the chassis with soldered connections. Panels are of 1/16 inch aluminum. The front and rear panels measure 4 1/2" by 5 1/2" and are fastened to the chassis with small self-tapping screws. One quarter inch square brass rods are used to fasten the top and side covers. The brass is drilled and tapped to accommodate 6-32 screws. Vent holes, shown in the photographs, are punched into the side and top covers with the aid of a small tube socket punch. Large rubber shock mounts (large grommets 3/4" round, one end of which has been molded to fit a 1/2" hole, 1/16" deep), are glued into 1/2" holes drilled into the bottom panel.

If the parts are arranged as shown in the photographs and in Fig. 2 there should be no r.f. feedback problems.

Only two leads in addition to the one to C_{2c} mentioned previously are shielded, *i.e.*, the speech input lead from the microphone jack and the one from the phase modulator to the oscillator (6AK5) grid. Shielded cable, such as is used for phonograph pickups, is employed throughout, with the shielding grounded to the chassis as often as possible. *RFC*, in the plate circuit of the reactance modulator, is mounted on the top of the chassis as shown in the photograph on page 43. In order to avoid further crowding of parts beneath the chassis, the 500,000 ohm potentiometer R, resistors R_5 and R_{10}, and condenser C_5, are mounted on the top of the chassis.

The frequency range of the oscillator is wide enough to permit coverage of most of the amateur bands, since it tunes from 3.3 mc. to well above 4.0 mc. The TV peaking coil *RFC*$_3$, shown in Fig. 1, in the plate circuit of the oscillator appears small, but when larger chokes were tried, there was no noticeable change in the output or stability of the unit. By keying the oscillator cathode circuit (keying pin jacks shown in photographs, lower left hand corner of front panel), the latter is silenced when the key is opened, thus making break-in operation possible.

A *Millen* stand-off insulator #30002 "Quartz Q" is sawed off to fit under the 1½" chassis and is used for the oscillator coil form L_3, Fig. 1. Although this type of insulator resembles lucite in appearance and cannot be used for the other stages due to the low temperature at which it melts; it was found to work satisfactorily for the oscillator coil. Other coil forms were tried, such as *National* XR2, and various kinds of wire were used. However, the *Millen* form, wound with #33 copper enameled wire produced the most stable results when the turns were covered with several thick coats of *Duco* household cement. (*Duco* was found to be a very good insulator when thoroughly dried.) When checking the fourth harmonic of the oscillator on 15 mc., beating it with WWV, there was no audible drift in frequency after the tubes were allowed to warm up. The amount of drift during the warm up period is almost negligible. Stability was found to be slightly improved by leaving the oscillator tube shield can off.

With 360 volts on the plates of the 6AQ5's, the plate current never exceeds 26 milliamperes input to each tube. Thus by putting 9.3 watts into them, their maximum plate dissipation is not exceeded. The 6AQ5's get very hot which is characteristic of the tubes, but nothing inside the small cabinet becomes overheated. The plate voltage of the 6AK5 oscillator tube is approximately 212 volts, while the screen voltage remains 100 volts, as regulated by the OB2 tubes.

While operating on 80 meters, the oscillator, buffer/doubler, and output stages are all on the same frequency, but no chirps are picked up in the monitor when the unit is keyed. The "Q" of the coils is kept high with the lengths of the windings measuring less than the diameters of the coil forms.

A phase-modulated type 6BA6 tube is coupled to the oscillator through the 10 $\mu\mu$fd. condenser C_5. Larger condensers, when used for this purpose, tend to overload the oscillator and cause too much frequency deviation; while a smaller capacity gives insufficient modulation swing. The switch, S_2 Fig. 1, on the FM volume control, cuts the plate supply to the speech amplifier and modulator tubes when the FM is switched off.

Bandswitching is accomplished by means of switch S_1, which is shown in photographs mounted on the right side of the cabinet. Both the doubler/buffer and final plate coils are center-tapped, so as to work on either 40 or 80 meters. With S_1 in the first position, or for 80 meter operation, L_2 and L_4 full coils are switched into the tube circuits. In the second, or 40 meter band position, the switch connects the lower taps of L_2 and L_4 to the 6AQ5 plates when L_2 doubles to the 40 meter band and L_4 acts as a straight amplifier. The third position of S_1, for twenty meter operation, places the lower tap of L_2 in the plate circuit of the second stage, which is doubling to 40 meters, and L_4 is switched into the final stage so that the output stage is also doubling. The plate coil L_4 is wound on a Scotch tape form, just large enough to make a tight fit inside of L_3 and is glued inside of the latter after it has been adjusted for maximum transfer of r.f. energy to the antenna link coil L_5.

After the r.f. stages are lined up cold with a grid dip meter to track with the oscillator tuning they are retuned after the metal cabinet cover plates are screwed on. It will be noted from the photograph, below, that the oscillator trimmer (C_{11}) plates are

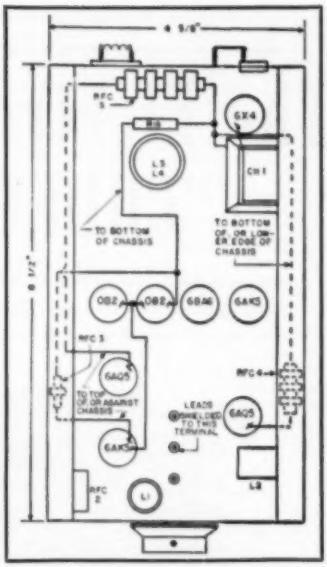
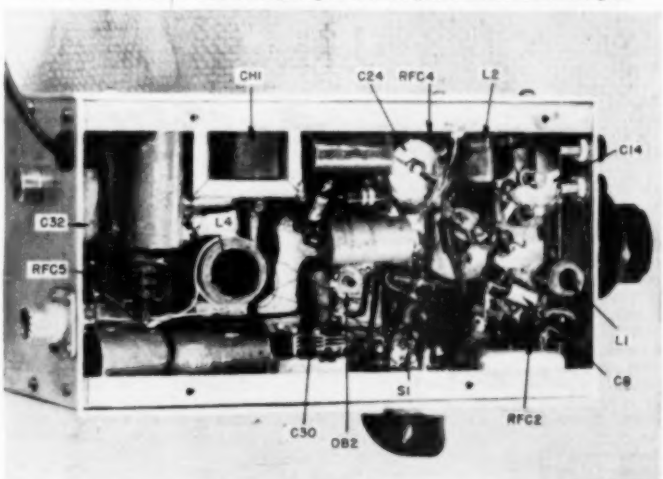


Fig. 2. Underchassis diagram showing location of the d.c. leads and r.f. chokes.

tuned half way out, or half of maximum capacity while C_{2a} and C_{2b} are almost all the way out, or minimum capacity. By holding a small neon lamp near the tuning condensers, on the top of the chassis, each r.f. stage is tuned for maximum brightness of the neon by adjusting C_{2a} and C_{2b}. C_{2b}, the output tuning trimmer, can be reached through the hole in the right side of the chassis. C_{2a} can be reached from the top of the chassis. Fine tuning adjustments are made with the aid of a field strength meter.

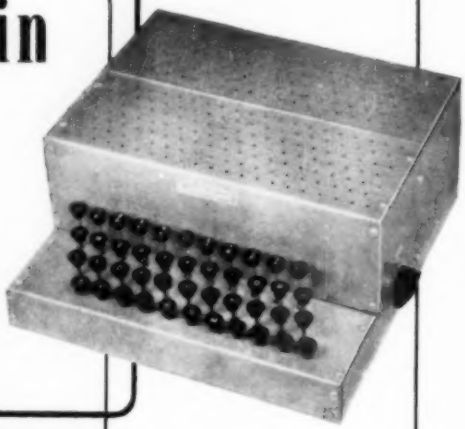
—30—

Underchassis view of variable frequency exciter. For parts identification, see Fig. 1.

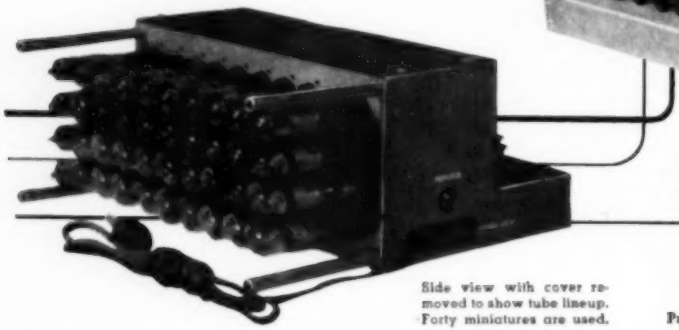


The Electronic Brain "CODETYPER"

Details on a completely automatic unit which requires no knowledge of code nor typing yet permits transmissions of from 10 to 75 wpm.



Front view of the "Codetyper" showing the typewriter-type keyboard with telegraphic symbols.



Side view with cover removed to show tube lineup. Forty miniatures are used.

By
NATHANIEL G. A. DORFMAN
President, Codetyper Laboratories*

ANOTHER advance in the field of automatic and semi-automatic communications equipment has been made with the development of the "Codetyper." This new instrument provides a method whereby Morse code signals can be transmitted automatically by pressing the correct key on a typewriter-like keyboard.

This new device eliminates two of the bugaboos of transmitting, i.e., "glass fist" and "signature" sending. While the first of these drawbacks is a handicap to the sender, "signature" sending can be of utmost importance in military transmissions where the enemy can use the distinctive sending style of an operator to identify troop units.

While there have been attempts in the past to eliminate the human element in code transmissions most of the instruments devised for the purpose have been complicated and costly. With equipment of this type the use of automatic code units was more or less confined to large or permanent installations.

There are, however, many thousands of transmitters being operated by individuals, and it is for persons such as these that the new "Electronic Brain Codetyper" was developed. It is operated simply by depressing a letter on a standard typewriter keyboard which forms part of the machine. When the key is depressed the "electronic brain" thinks up all the various timing combinations that are needed, assembles the correct number, puts them in the proper sequence, and then sends them out so that they can be used to key the transmitter. The "Codetyper" directly replaces the usual hand key and is simply clipped across the key that is normally in use, or rather that was in use as it won't be needed with this new unit.

An instrument of this type must be suitable for use at all of the code speeds normally employed, so accordingly this unit is adjustable for speeds from 10 to 75 words-per-minute. No knowledge of code or typing is required to use the "Codetyper." One finger is adequate for the most commonly used code speeds but if the machine is to operate into some recording device at the receiving end, the operator can use touch typing and send speeds of 50, 60, or 75 words-per-minute and up. The unit can also be supplied with speeds from 75 to 125 wpm. Two models cover the machine's range of from 5 to 125 wpm—the slow speed model from 10 to 75 wpm and the high speed model from 50 to 125 wpm.

The design of the "Codetyper" presented a number of interesting problems. The random nature of the International Morse code makes it difficult to supply all of the various waveforms that are needed. The information which is contained in Morse code characters varies in many ways. In all of the letters, numerals, and punctuation marks there are different over-all time intervals involved in forming the characters. Since the characters are composed of dots and dashes, the number of dots and dashes within the over-all time interval will vary considerably. The sequence of dots and dashes within a character also varies widely.

To meet these problems, this system works on the principle of a single information-forming channel which may be instantaneously triggered into many different states depending on which part of its memory connections is activated. In the static condition the channel is non-operative, but it can assume any random combination of time units in a dynamic state which can be used to generate the proper number and arrangements of pulses which are then used to activate a relay to key the transmitter. This method eliminates many of the complexities that would be imposed by a system which called for intermixing marking and spacing intervals as well as controlling the length of the letter. With this system letter length timing is automatic and no dash marking generators are required as the unit automatically scales the dash marking intervals down as controlled by dot marking intervals and the intermixing operation does not have a timing component.

There is a basic code for the arrangement of the units of the Morse code. The system by which this is done has been reformulated into a system

* 550 Fifth Ave., New York 19, N. Y.

suitable for use by the "Codetyper." The Morse code, made up of dots and dashes, can be considered to consist of different time intervals within the character to be formed. The dot has the smallest interval. It can, then, be used as a base and assigned the number 1. Counting up all the other characters, there are 19 units in all, figuring all spaces within the character to be formed as 1 unit. If a "unit code" is set up, each character will have a different number of units. Under the system by which the "Codetyper" operates there has to be a common reference point irrespective of the length of the letter. The first step is to set down the Morse code according to "units" but instead of starting from the number 1, it was decided to start from number 19 and work backwards. For example, the letter "E" is represented by the number 19. The letter "S," on the other hand, is represented by three units, 19, 17, and 15. The spacing interval within the character is figured into the over-all units so that the letter "S" would be a 5 unit letter—3 marking and 2 spacing intervals. The letter "S" as well as all other letters irrespective of length, will terminate on unit 19. The basic principle of the "Codetyper" is to take a single information-forming chain and derive from it as many units as are needed to complete the letter.

In addition to this information-forming chain, which collectively is known as the "unit interval generators," there are several other parts to the circuit. The "unit interval generators" are 19 in number since it is necessary to generate 19 intervals. The output of these generators consists of pulses which are fed to a keying relay which operates the transmitter. It is necessary that the keying relay be activated by all of the "unit interval generators" in time series yet be able to receive pulses from all of the "unit interval generators" at a common point. In order to accomplish this there are keyers in the "Codetyper" consisting of a series of tubes arranged with their inputs in series and their outputs in parallel. Since no dash markers are generated, a definite system for forming dash markers is needed in the keyer section, thus this section is used for that purpose as well.

To form the dash markers on the keyers, there has been incorporated another section which has been designated "sequence selectors." These units are used to gate on any number or combination of keyers so that whenever the "sequence selectors" are operated they are able to provide dash markers as needed within the train of pulses constituting the character. The operation of the "sequence selectors" which help to form the dash markers is under the control of the keyboard. The keyboard will turn on as many of the "sequence selectors" as are needed by means of the associated "phantom switch network."

The "phantom switch network" consists of a group of resistors and neon bulbs arranged in such a way as to allow an extremely simple single-pole, momentary-contact switch to initiate as many as six circuits simultaneously, which means in effect that a single-pole switch acts as a six-pole switch because of the action of the circuit of the "phantom switch network." This network has two functions. The first is to turn on as many of the "sequence selectors" as are needed to form the dashes required by a particular character. The second function is to take a voltage from the network and trigger the proper "unit interval generator" so as to provide the total number of pulses needed.

When the keyboard is depressed, the proper number of "sequence selectors" operated, and a particular "unit interval generator" triggered, the character starts to form, travels down the chain of "unit interval generators," and activates the keyers. The complete code character has now opened and closed the keying relay so that the Morse code is formed.

In analyzing the operation of the "Codetyper" it is well to examine the functioning of the "unit interval generator" (UIG) of which there are 19. Normally, the entire chain is held at cut-off, that is, all the pulse generators are biased so that there is no pulse output. The pulse generators incorporate 6J6 tubes in a univibrator circuit and all of the generators are identical. Triggering the first univibrator in the chain gives two output pulses. One pulse is used to feed the keyer and the other is used to trigger the next UIG. These two pulses are of two different waveforms—the one that activates the keyer is substantially a square wave of a time duration that is under the control of the speed control, the other pulse which is used to trigger the next UIG is a sharp spike which is caused by differentiating the trailing edge of the square wave pulse appearing across the cathode resistor of the UIG. This pulse is applied to the grid of the next "unit interval generator."

The pulse which is taken off the plate of UIG #1 is coupled directly, through an isolating resistor, to the grid of keyer #1 by d.c. coupling in order to avoid time constants.

To allow UIG #1 to deliver its pulse

(*Continued on page* 163)

Top view with cover removed to show mechanism.



Under chassis view with the base plate removed.



CORNER LOUDSPEAKER ENCLOSURE

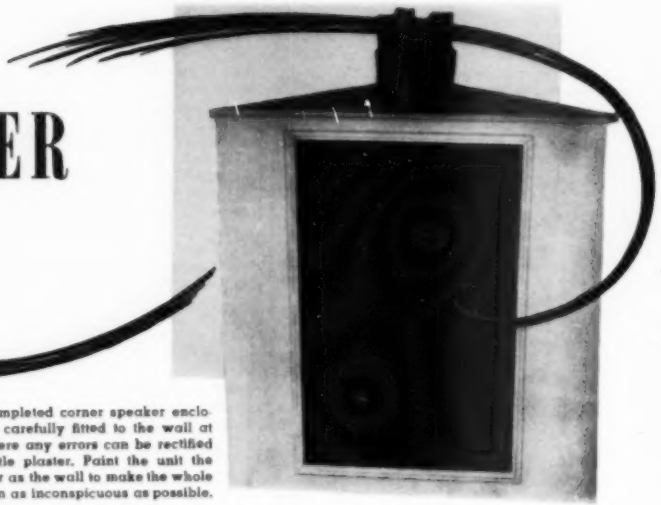


Fig. 1. Completed corner speaker enclosure. It is carefully fitted to the wall at edges where any errors can be rectified with a little plaster. Paint the unit the same color as the wall to make the whole installation as inconspicuous as possible.

By
RICHARD H. DORF
Audio Consultant

Designed to accommodate both woofer and tweeter speakers — cabinet can be home-built for $10.00.

EVERY audio authority agrees that placing the speaker of a high-quality system in a separate cabinet from that in which the amplifier and record player are mounted is the best practice. But a good reason why it is not done more often is that the lady of the house objects to having *another* big piece of furniture in a room already full of furniture. Another reason is that very few cabinetmakers will make a really good enclosure for less than about $100, including a genuine furniture finish.

There is, however, a good way to get around both difficulties. First, however to convince the lady that a separate enclosure is needed, you can cite the following facts:

1. If the system is any good at all, the sound coming from a speaker in the same cabinet will vibrate the wood; the phonograph pickup (or perhaps a microphonic tube) will pick up the vibrations, feed them into the amplifier again, and create a continuous and nerve-wracking steamboat-whistle effect. The only two solutions to that are (*a*) to build the cabinet of concrete or (*b*) to play the instrument so softly you can't hear it.

2. You need a big cabinet to get good bass, unless you want to play with tuned ports, a trick that may make a symphony orchestra sound as though it were playing in a barrel. To get 10 cubic feet of air behind the speaker and *also* mount turntable, amplifier, power supply, and tuner in the same cabinet, you will need a box big enough to live in.

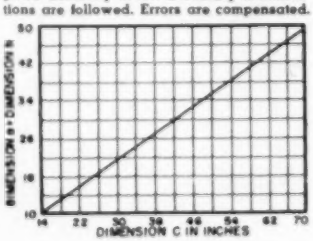
3. This one is a little more subtle and must be explained just right. When the sound comes from the same place where you know the record to be, you have a mental picture all during the music of a disc whirling around. As a result, your own mind gives the music a "canned" feeling, no matter how good it really sounds. On the other hand, when the speaker is in a different place, that effect is no longer present. With your attention on the music, you can ignore the whirling record because the music and the disc are no longer in the same place. This may sound fantastic if you've never heard a separately placed speaker, but the first time you try it, the meaning will hit you with a bang!

4. Everybody says the speaker should be separate. (This argument is only a last resort, to be used when your own prestige has failed and you need to call on the "Authorities.")

A good deal of the pain and expense can be taken out of the separate cabinet idea, however, by the simple device of using a corner for it. A speaker system placed in a corner is in the best possible position to cover the entire room with sound, especially at the higher frequencies.

The simple corner cabinet shown in the photo requires exactly two pieces of wood, ¾-inch plywood. One is cut out for the woofer and tweeter and placed across the corner to form the front of the enclosure. The other is triangular and forms the top. The two intersecting walls are the remaining two sides and the floor of the room is the bottom. Total cost of the unit pictured, including having a local cabinetmaker cut the two pieces (and the speaker holes) on his rotary saw, was about $10. Soundwise, you couldn't buy a better enclosure. And almost any living room has a corner that isn't doing anything.

Fig. 2. Graph for determining dimension "c" when "a" and "b" (Fig. 4) are equal. Three-place accuracy is not necessary if instructions are followed. Errors are compensated.



The basic requirement for an "infinite" baffle is infinite isolation between the front and the back of the speaker. Since that isn't possible, the idea is to get as much air as possible behind the speaker and still isolate the front from the back. As a rule of thumb, 10 cubic feet of air within the enclosure is about the minimum for really good reproduction.

That makes calculation of the measurements simple. Fig. 4A is a mechanical drawing of a corner enclosure like the one in the photo. The three important dimensions for calculation purposes are *a*, *b*, and *d*. Note that *c* does not count at this time. Dimension *c* is just the board width but unless you want to get more complicated than necessary, don't use it in figuring the volume. The following simple formulas give volume in terms of the *a*, *b*, and *d* dimensions and also each dimension when the others are known:

$$V = abd/2 \quad . \quad . \quad . \quad . \quad . \quad (1)$$
$$d = 2V/ab \quad . \quad . \quad . \quad . \quad . \quad (2)$$
$$b = 2V/ad \quad . \quad . \quad . \quad . \quad . \quad (3)$$
$$a = 2V/bd \quad . \quad . \quad . \quad . \quad . \quad (4)$$

Suppose $a = 3$, $b = 3$, and $d = 3$. Then $V = 3 \times 3 \times 3/2 = 13.5$ cubic feet, the volume of the enclosure. Or suppose you want a volume of 10 cubic feet; a is 2, b is 2. What is d? Using formula (2), $d = 2 \times 10/2 \times 2 = 5$ feet. And so on.

You may be afflicted, as I am, with corners that look like that in Fig. 4B. If so, make the calculations as before, just as if the gadget in the corner weren't there. To do that use the measurements shown in Fig. 4B with the formulas above. For a substitute $a' + b''$, and for b substitute $b' + a''$. Then figure the volume of the corner projection and subtract it from the total.

The next order of business is to get or cut the two pieces of wood. For the front the height is simply dimension d. The width of the front can be found by the empirical method if you have long enough arms but a graph (Fig. 2) is given to save you the trouble. It is based on the fact that, according to Euclid, the square of the hypotenuse of a right triangle is equal to the sum of the squares of the other two sides. This graph will work only if dimensions a and b are identical in Figs. 4A and 4B. You will get the best coverage of the room if they are, but sometimes you will have to make them unequal because of the way the room is built. Don't try to read between the graph calibration marks too exactly; it isn't necessary, especially if you figure the enclosure for a little more than the volume you want.

When you have dimensions c and d, cut the board for the front. Do not cut the side edges straight, however, but at a 45-degree angle so that when the board is placed against the wall its edges will blend into the wall.

For the top, the safest way to cut is illustrated in Fig. 4C, if you have provided for equal lengths for a and b. First cut a board to the width of dimension c and match it to the already prepared front piece to see that they are the same. Then set the tri-square for 45 degrees and draw a line from each end of the front inward until they intersect, as shown. Cut along the lines and you have the top. If your corner looks like Fig. 4B make the necessary cutout in the top, as indicated by the dashed lines in Fig. 4C. Complete the heavy work by cutting out holes in the front piece for the woofer and tweeter. The holes need not be smooth, for they will be hidden.

There are two ways to fasten the front piece to the wall. The easiest is to place it in position, then drill through both board and wall the four holes indicated at S in Fig. 4A. Long toggle bolts can then be pushed through the wood and plaster and tightened. The other method is to nail or bolt long strips of 1-inch-square wood to the wall and, in turn, fasten the front board to them.

The top piece sits on top of the front board, which then supports its front edge. The other two edges are supported by two pieces of 1 x 1 fastened to the wall at the right height. It is not necessary to fasten the top in place. Three-quarter-inch plywood is heavy enough to stay put and the top is easy to remove when adjustments are to be made inside.

If, as in the enclosure pictured, the woofer and tweeter holes are near enough to the top, the speakers can be mounted after the front is in place. If there is any doubt, however, fasten them in before the board is fastened to the wall. In any case, line the entire surface of the enclosure's inside—wall and floor as well as the two pieces of wood—with soft padding. *Ozite*, usually used as a base for rugs, is perfect for the job, but cotton batting from the drug store will do, too.

If there is any possibility that children, dogs, or careless adults may poke something through the woofer cone, get some galvanized screening with about ½-inch spacing and place it between woofer and cabinet. To complete the construction job, get a piece of molding ¾ inch wide and nail it in place across the outer edge of the top piece. (See Fig. 1.)

Now the finishing touches. Get either a can of plastic wood or a bag of plaster. The latter, mixed to about the consistency of cold cream, seems to be easiest to handle. With a wide putty knife work it in along the side edges of the front piece so that when you are finished the front blends in smoothly with the wall. If your wall has very fancy woodwork along the bottom edge as did the writer's, the front piece will have been cut roughly to conform with the shape of that woodwork. Plaster is then used to fill any gaps between board and woodwork.

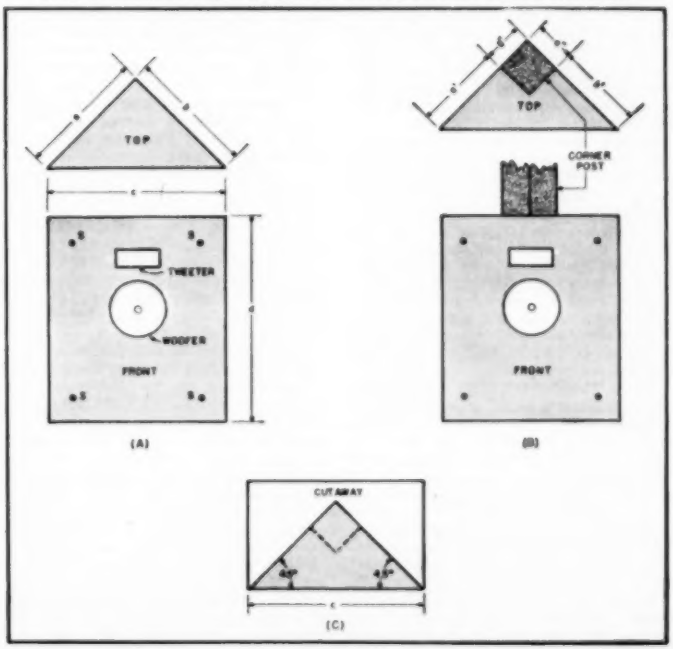


Fig. 3. After the front board is in place, nail a pair of 1 x 1 inch strips to wall to support the top, then paint the area to be covered by the grille cloth with a dark paint so holes do not show through the cloth. Dark green was used by author.

The next job is to make a simple frame of four lengths of molding. The size should be enough to more than cover the two speaker holes. Now put the frame in place over the front and

(*Continued on page* 126)

Fig. 4. (A) Sketch of enclosure for a clear corner showing dimensions of two pieces required. (B) When corner has a post, the top must be cut out. Dimension (a) becomes (a') plus (b") and (b) becomes (b') plus (a"). (C) To make top, cut a rectangular piece of wood to dimension (c), then draw lines at 45 degrees from each corner with carpenter's square. If lines are correct, intersection will be a right angle.



A Low-Cost AUDIO AMPLIFIER



Fig. 1. Top and under chassis views of the low-cost amplifier. Entire unit is built in 4" x 3" x 5" box.

By
FREDERIC T. C. BREWER

Less than ten dollars for a complete audio amplifier that boasts a frequency range of from 50-20,000 cps.

AUDIO holds a fascination for a variety of enthusiasts, including the engineer, musician, and the hobbyist. Any and every phase of the art seems to interest them as evidenced by the increasing number of audio articles appearing in magazines. However, many are not content to just read about the new devices and circuits, but long to try them out. You have probably picked up this magazine many times and found a super hi-fidelity amplifier described and have had to be content with reading superlatives about its performance simply because the necessary parts would cost a small fortune—not to mention the time that would have to be spent duplicating it. Do not interpret this to mean that I am against such articles—far from it—for I am one of those self-same enthusiasts. This article is written with the purpose of presenting an audio amplifier that can not only be talked about but that can be duplicated in about an hour's time for less than ten dollars.

Even though the circuit incorporates three feedback loops, it will give no trouble. Even the novice can anticipate results comparable to those obtained by persons more experienced in electronics.

Construction Hints

As can be seen from the photograph of Fig. 1, the amplifier is compact, being entirely constructed in a 4"x3"x5" steel utility cabinet.

None of the parts is critical and wide variations in values can be tolerated without loss in performance. Most, if not all, of the parts can be found in the proverbial junk box. Even if all new parts are used, the cost should be under ten dollars.

Remove the top plate of the utility cabinet. Then make the holes for the three tubes, the filter condenser can, and the input and output jacks. Next mount those parts. The electrolytic condenser can we used was a *Mallory* four-section, 20 mfd.-per-section condenser, rated at 450 volts. Of course 150 volt condensers may be used. We used the 450 volt condenser because it was on hand, and by using it we were sure of the wide safety margin that we wanted in order to insure continuous, uninterrupted service. We mounted the can condenser so that it was insulated from the top plate. This was accomplished by placing the fiber mounting template on top of the top plate making sure that the prongs did not touch the top plate when the condenser was inserted.

Two sections of this condenser are wired in parallel in order to obtain a value of 40 mfd. for the filter-input condenser. The tubes, a 12SH7, 50L6, and 35Z5, because of their wide use, are relatively cheap. Male, non-shorting chassis mounts were used for the input and output jacks. Again, any type of jack might be used.

The fiber washers that keep these mounts from shorting to chassis were removed from the input mount, and it became the only ground point for the amplifier. A bus wire was run from this ground point to a prong on the insulated electrolytic can, and all grounds were brought to this bus.

With the top and bottom plates of the utility cabinet removed, it is relatively easy to mount the filter choke, output transformer, pilot light assembly, loudness control, power switch, and fuse holder. The output transformer is mounted on the left face of the utility cabinet directly below the output jack. The filter choke is mounted on the right face of the utility cabinet under the rectifier tube and filter condenser. This arrangement keeps leads short and fields to a minimum. The power cord is brought in through a rubber grommet on the back face next to the fuse holder. We wired the top plate, leaving until last leads that went to the components inside the cabinet. After all wiring was done, except the connections between the top plate and the parts mounted in the cabinet, we mounted the top plate. Since these connecting wires were already wired to their respective points on the top plate, the remaining connections were made with ease.

All the components in the parts list are standard items and judicious substitution of parts on hand can be made without fear of complications. As an example, the output transformer is listed as a *Stancor* A3876; however, an output transformer from any radio or amplifier using a 50L6 or equivalent output tube will do just as well.

To keep hum to the vanishing point, it is recommended that the pilot light be connected as shown in Fig. 2 (instead of the usual method employed when a 35Z5 rectifier tube is used). While we are on the subject of hum, it might be pointed out that by having the feedback loops connected as they are, practically all hum in the output due to "B+" ripple is canceled out. Since the loudness control is returned to ground through the secondary of the

output transformer, especially good results are obtained when the amplifier is operated at low levels in extremely quiet surroundings.

Certain precautions should be taken when this amplifier is put into use. The amplifier is of the a.c.-d.c. type, and since no power transformer is used, a certain danger exists. We recommend that the entire amplifier be enclosed in, or behind, a cabinet or partition of some insulating material, *i.e.*, wood or plastic. No metal parts which are connected to the chassis should be exposed, since the chassis is connected directly to one side of the line. One method of overcoming this problem would be to use a polarized plug, so that the chassis would always be at ground potential. Another would be to connect the chassis directly to a good external ground, and then connect only the "hot" lead to the appliance plug. The amplifier would not operate if the plug were inserted with the wrong polarity.

Feedback Loops

To get the feedback loops working correctly does not require instruments. It can easily be accomplished as follows: ground either side of the secondary of the output transformer and wire it as shown in Fig. 2. Should the amplifier begin to squeal when you first turn it on, turn it off and interchange the two leads from the secondary of the output transformer. Turn on the amplifier again, for nothing more need be done. The positive feedback loop does not require any change or adjustment.

The feedback loop provided by connecting the volume control in series with the secondary of the output transformer is somewhat unorthodox, but produces exceptionally good results. The amount of feedback varies with the setting of the volume control, being maximum at the minimum setting of the control. With the control set at the point where a 1 volt input produces a 1 watt output at 1000 cps, there is 30 db of negative feedback. Connecting the cathode of the 50L6 in series with the output transformer secondary adds about 2 db, and the 12SH7 screen bypass connection adds another 4 db of negative feedback. The resistor between the cathodes of the 12SH7 and the 50L6 provides 10 db of positive feedback.

Performance

I would like to describe first the results of testing with instruments. I know those of you who believe in listening tests are saying, "Here we go again!" However, most of us like to see in the form of graphs, etc., what our "golden ears" tell us is perfection.

The frequency response at moderate power levels, adequate for normal room listening, is shown in Fig. 3, both with a 5-inch speaker load and with a 4-ohm resistance load. At lower power levels, the response is essentially a straight line from 40 to 40,000 cps, while at higher power levels the response drops off somewhat at the higher frequencies and drops off quite rapidly at lower frequencies, due to saturation of the small output transformer. Greater power output at the lower frequencies could readily be obtained by using a larger and more expensive output transformer. It was not felt that the slight improvement in performance justified the additional bulk and expense in this case, since performance with the transformer indicated was so highly satisfactory on the basis of listening tests. Maximum power output at reasonable distortion is about 1.2 watts.

Before you pass judgment on what seems like inadequate power output, remember the millions of sets using the same output tube and a small 5 inch speaker, or re-read James A. Mitchell's article "Loudness and Power in Audio Systems," which appeared in the February, 1951, issue of this magazine.

The internal impedance is 0.27 ohm at 60 cps, and since at this frequency the output, as shown by the frequency response curve, is near its lowest value, it is evident that at higher frequencies the internal impedance will drop even lower. However, we are more interested in the damping out of the large cone excursions of our speaker at low frequencies. We believe the low internal impedance partly accounts for that intangible "presence" effect experienced when listening to this amplifier.

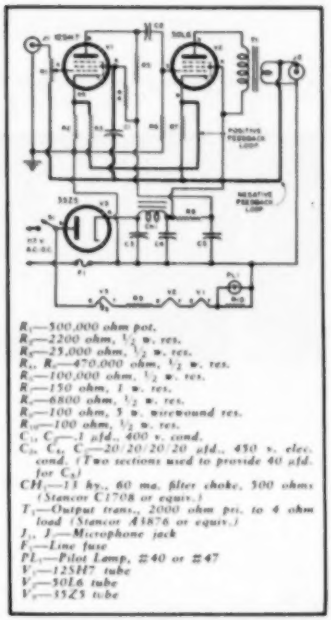
Listening tests were made with speakers ranging in size and quality from a single 4 inch unit to an elaborate *Tru-Sonic* two-way theater system. When the amplifier was used with the *Tru-Sonic* system and fed with program material from an FM tuner the results were exceptional. Results from other combinations were also completely satisfactory.

As a further test of the hum content (our instruments did not register any value at hum frequency) we turned the loudness control up full, with an open input, and listened at close range to an efficient speaker. It was absolutely dead. When used with a tuner, if there is any hum, reverse the power plug of the tuner or amplifier socket.

The 12SH7 input tube was chosen because of its high gain. However, in some cases it is possible to secure a slight reduction in hum by substituting a 12SJ7 for the 12SH7. This will result in some decrease in over-all gain, but in most cases this reduction will be insignificant. By connecting pins 3 and 5 of the 12SH7 socket together, the 12SJ7 may be inserted directly without further changes.

Conclusion

The construction hints given in this article are just that; it is not necessary to follow them exactly. The author, over a period of time, has constructed numerous amplifiers based on the design outlined in this article with variations as to shape and size but all of them have worked exceptionally well. I know that those who take the time to duplicate this amplifier will be well rewarded by its performance.



R_1—500,000 ohm pot.
R_2—2200 ohm, ½ w. res.
R_3—25,000 ohm, ½ w. res.
R_4, R_5—470,000 ohm, ½ w. res.
R_6—100,000 ohm, ½ w. res.
R_7—150 ohm, 1 w. res.
R_8—6800 ohm, ½ w. res.
R_9—100 ohm, 5 w. wirewound res.
R_{10}—100 ohm, ½ w. res.
C_1, C_2—.1 μfd., 400 v. cond.
C_3, C_4, C_5—20/20/20/20 μfd., 450 v. elec. cond. (Two sections used to provide 40 μfd. for C_5)
CH_1—11 hy., 60 ma. filter choke, 300 ohms (Stancor C1708 or equiv.)
T_1—Output trans., 2000 ohm pri. to 4 ohm load (Stancor A1876 or equiv.)
J_1, J_2—Microphone jack
F_1—Line fuse
PL_1—Pilot Lamp, #40 or #47
V_1—12SH7 tube
V_2—50L6 tube
V_3—35Z5 tube

Fig. 2. Schematic diagram and parts list for low-cost amplifier. The several feedback loops that author used are quite novel. The positive loop is used to increase over-all gain of the unit. Negative feedback to the screen grid of the 12SH7 maintains over-all negative feedback when the volume control is in its maximum position. The feedback circuit to the lower end of the volume control serves a dual purpose. It is relatively ineffective when volume control is at maximum position. Maximum gain is therefore obtained where it is required. As the volume control is decreased, the effect of feedback is increased, thus providing maximum feedback at the minimum setting of the control.

REFERENCES

Smith, F. L., "Radiotron Designer's Handbook," Third Edition, The Wireless Press.

Cooper, George Fletcher, "Audio Feedback Design," Radio-Electronics, October, 1950 through November, 1951.

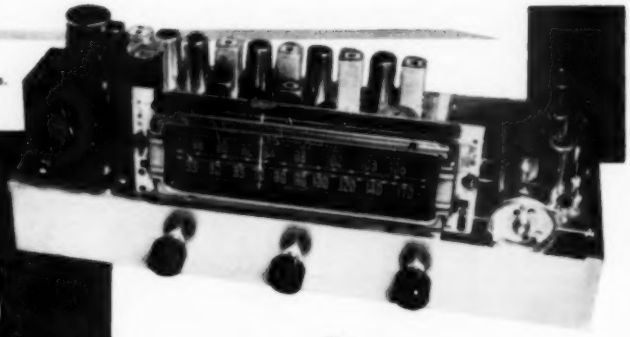
Terman, F. E., "Radio Engineering," Third Edition, McGraw-Hill Book Company.

-30-



Fig. 3. Frequency response at medium power levels. Dotted line is response with 3.2 ohm, 5" speaker load. Solid line shows response with 4 ohm resistance load. Ordinate scale is arbitrary, based on 0 db representing 1 watt output at 1000 cycles.

Completed assembly built from "Pre Fab" units.



"PRE-FAB" TUNERS

By
W. H. COLLINS
Collins Audio Products Co. Inc.

Pre-assembled units simplify construction, particularly for the inexperienced radio builder.

A PACE with the rapid advances television has made in the past five years, radio too has forged ahead, ably supported by high-fidelity FM reception and topnotch programming by the stations. An innovation in the radio field is the *Collins* "Pre-Fab" tuner, recently introduced as an FM tuner kit and later expanded to include AM. This design represents an entirely new approach to kits in that the tuner is broken down into its basic circuits for ease and accuracy in manufacture, as well as facility in assembly for the user.

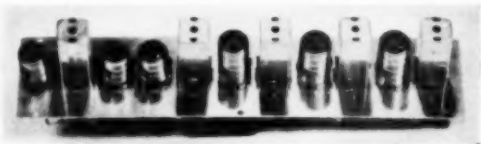
Current design for home listening of high-fidelity reception prescribes an integrated system composed of a radio tuner (FM and AM), a wide-range audio amplifier, quality record changer, and separate loudspeaker unit. People interested in providing their homes with fine entertainment equipment are rapidly turning toward this new medium. Much standardization has taken place in recent years and it is a relatively simple matter for even an inexperienced person to assemble the units of his selection without specialized technical knowledge.

Modern design in the contemporary living room dictates that the radio and phonograph equipment be "built-in" wherever possible or installed in choice furniture pieces. In addition, much fine audio equipment has been made available and is being purchased in an ever increasing volume by an eager and interested public. At last they have found what they have been seeking—true and faithful audio reproduction in the home!

Purchasing completed components can be costly if one's taste demands perfection. In this connection though, *Collins Audio Products* figured that it was possible to provide high grade equipment at moderate cost if the purchaser were willing to do a little work himself. Since there is only a relatively small group of people in the country who understand the technical aspects of radio, *Collins* kept this in mind in designing the "Pre-Fabs."

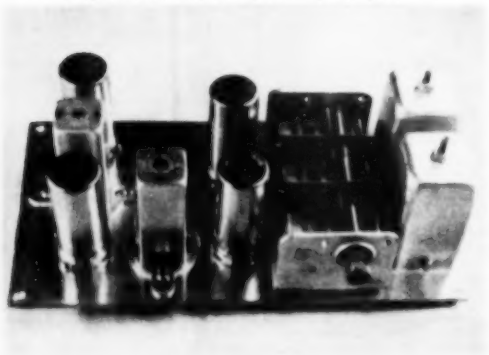
By making up the basic circuit components separately, an inexperienced person can put them together, connect an absolute minimum of wires, and obtain performance comparable to that available from a factory-built, completely assembled job. By so doing, the builder saves many dollars in addition to having the satisfaction and feeling of accomplishment which comes from contributing personally to his radio system.

The "Pre-Fab" kit is composed of four basic units: (1) The FM r.f. tuning unit, (2) the FM intermediate frequency amplifier, (3) the AM tuning unit, and (4) the chassis kit, which includes the power supply, dial assembly, and necessary hardware *(Continued on page 124)*

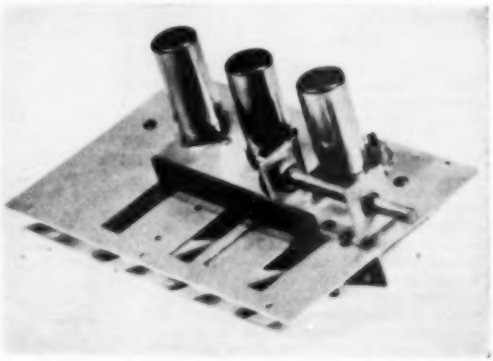


Chassis strip carrying the FM i.f. amplifier unit.

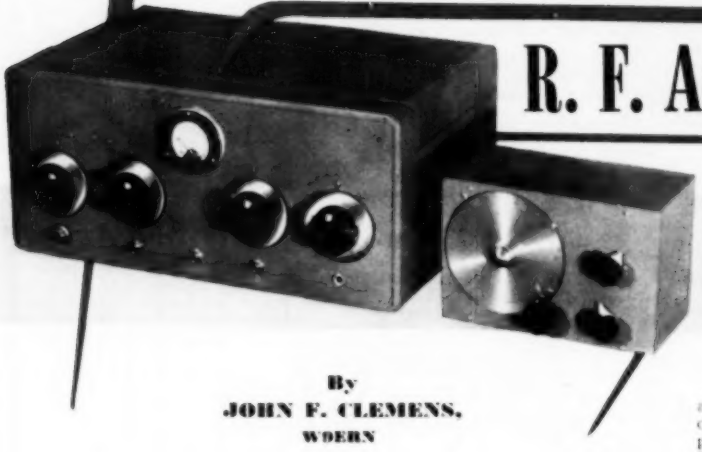
View of the AM tuner and its accompanying i.f. unit.



The Collins "Pre-Fab" FM tuning unit chassis strip.



150-Watt Universal R. F. Amplifier



Front view of amplifier, shown with the exciter unit described by the author in last month's issue. The power supply for the amplifier is also used to operate the exciter section.

By
JOHN F. CLEMENS,
W0ERN

Take your pick of C.W., FM, AM, or SSSC—this unit handles them all on any band—and without any TVI.

A MODERN amateur transmitter must meet a variety of specifications. It must operate over a wide frequency range as a first requirement and practically every amateur desires a transmitter which will give him the choice of phone or c.w. Experience has shown that it is usually unwise to try to incorporate too many features into one piece of equipment. It is necessary instead to compromise somewhat, retaining those features which operating experience has shown to be desirable, and eliminating the "gingerbread" features. The design of this equipment was an attempt to follow this policy and in over a year of use on the air, on all bands from 80 to 10 meters, on phone and c.w., it has justified its builder's confidence.

The amplifier is "universal" in the sense that it will amplify any sort of r.f. signal of approximately one-fourth watt to two watts on any of the commonly-used bands. Instead of the usual class C amplifier, the two stages are operated as class A and class B linear amplifiers. Thus, the unit may be used to amplify any type of signal, whether it be c.w., AM or FM phone, or single-sideband. Don't let that "linear amplifier" idea scare you—this transmitter is no more difficult to adjust than any conventional class C rig. The tube electrode voltages are set to the proper handbook values and from there on it is merely a matter of setting the input signal level and the output coupling. Two dials on the front panel make these adjustments and the plate meter is all you have to watch in tuning up.

All bands are covered by means of plug-in coils. Bandswitching was not included in the interest of compactness, efficiency, and good layout from the TVI suppression standpoint.

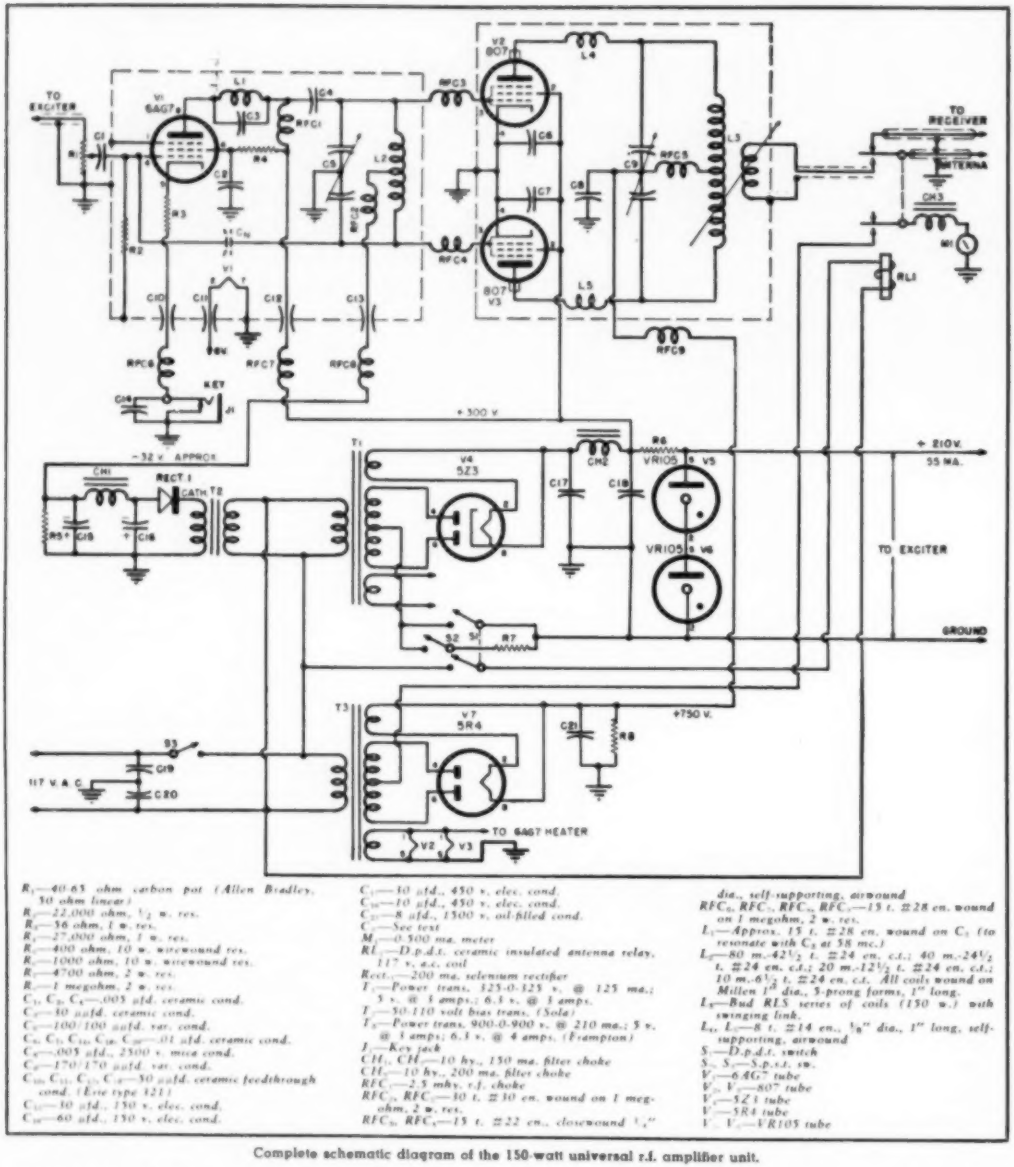
A great deal of attention was given to the very important problem of eliminating spurious radiations which cause BCI and TVI, with the result that careful measurements show the strongest harmonic to be 72 db below the carrier when operating on ten meters. This is considerably better than the FCC requirement of −60 db for a transmitter of this power. This harmonic suppression has been achieved without *tuned* traps or filters which would be effective at only one frequency. Shielding has been the principal means of reducing unwanted radiations plus a mode of operation which generates weak harmonics.

An elaborate shielding job usually requires a great deal of special sheet metal work which the average ham cannot perform with hand tools. Standard utility boxes are used in this design with a standard chassis and a standard-size cabinet. The cabinet shown is from a *Hallicrafters* S-56 receiver, which has the same nominal dimensions as the *NC*-100X receiver. The chassis measures 11" x 17" x 2" and a heavy-duty plated (not painted) steel type is recommended. After the shield boxes have been laid out on the chassis, the mating areas of the chassis are masked with tape to keep them clean and the chassis is painted to improve its appearance and prevent rust. The two shield boxes are steel utility boxes, the one housing the final amplifier tubes and tank circuit measuring 9" x 5" x 6" and the smaller one which houses the 6AG7 stage components measuring 3" x 4" x 5". The flanges of these boxes should be sanded bright before they are mounted on the chassis with self-tapping screws. The two 807 sockets are submounted approximately one inch below the chassis by means of inverted *Eby* base-mounting shells. This drops the tube plate caps about ¾ inch below the copper screen over the top of the box. Aluminum shields are used inside the box around each 807 to reduce feedback to the grids. Neutralization of the final amplifier has been found unnecessary. A small aluminum panel was used to replace the steel lid supplied with the smaller shield box to avoid the labor of sanding off the heavy crackle finish. An aluminum coil shield is used over the plug-in coil which is the final amplifier grid coil as well as the driver stage plate coil.

To make the shielding effective it is important that no ungrounded metal shafts pass through the shield wall. Insulated shaft extensions are used on all the controls to the dials on the front panel.

The front panel controls, as seen in the amplifier pictured above, include output coupling, plate tuning, final grid tuning, and r.f. excitation. The switches on the front panel control power "on" and "off," exciter "on" and "off," and high voltage "on" and "off." The keying jack is located below the r.f. excitation dial.

Push-pull 807's are unbeatable in a transmitter of this type. The driving power is very low, the tubes are inexpensive, and the push-pull connection reduces harmonic content in the plate circuit. Class B operation has other



R_1—40-65 ohm carbon pot (Allen Bradley, 50 ohm linear)
R_2—22,000 ohm, ½ w. res.
R_3—56 ohm, 1 w. res.
R_4—27,000 ohm, 1 w. res.
R_5—400 ohm, 10 w. wirewound res.
R_6—1000 ohm, 10 w. wirewound res.
R_7—4700 ohm, 2 w. res.
R_8—1 megohm, 2 w. res.
C_1, C_2, C_4—.005 μfd. ceramic cond.
C_3—30 μμfd. ceramic cond.
C_5—100-100 μμfd. var. cond.
C_6, C_7, C_{10}, C_{12}, C_{13}—.01 μfd. ceramic cond.
C_8—.005 μfd., 2500 v. mica cond.
C_9—170-170 μμfd. var. cond.
C_{11}, C_{14}, C_{15}, C_{16}—50 μμfd. ceramic feedthrough cond. (Erie type 121)
C_{17}—30 μfd., 150 v. elec. cond.
C_{18}—60 μfd., 150 v. elec. cond.
C_{19}—30 μfd., 450 v. elec. cond.
C_{20}—10 μfd., 450 v. elec. cond.
C_{21}—8 μfd., 1500 v. oil-filled cond.
C_{22}—See text
M_1—0-500 ma. meter
RL_1—D.p.d.t. ceramic insulated antenna relay, 117 v. a.c. coil
Rect.—200 ma. selenium rectifier
T_1—Power trans. 325-0-325 v. @ 125 ma.; 5 v. @ 3 amps.; 6.3 v. @ 3 amps.
T_2—30-110 volt bias trans. (Solar)
T_3—Power trans. 900-0-900 v. @ 210 ma.; 5 v. @ 3 amps; 6.3 v. @ 4 amps. (Triumph)
J—Key jack
CH_1, CH_2—10 hy., 150 ma. filter choke
CH_3—10 hy., 200 ma. filter choke
RFC—2.5 mhy. r.f. choke
RFC_3, RFC_4—30 t. #30 en. wound on 1 megohm, 2 w. res.
RFC_5, RFC_6—15 t. #22 en., closewound ¼" dia., self-supporting, airwound
RFC_7, RFC_8, RFC_9, RFC_{10}—15 t. #28 en. wound on 1 megohm, 2 w. res.
L_1—Approx. 15 t. #28 en. wound on C_3 (to resonate with C_3 at 58 mc.)
L_2—80 m.-42½ t. #24 en. c.t.; 40 m.-24½ t. #24 en. c.t.; 20 m.-12½ t. #24 en. c.t.; 10 m.-6½ t. #24 en. c.t. All coils wound on Millen 1" dia., 5-prong forms, 1" long.
L_3—Bud RLS series of coils (150 w.) with swinging link.
L_4, L_5—8 t. #14 en., ⅜" dia., 1" long, self-supporting, airwound
S_1—D.p.d.t. switch
S_2, S_3—S.p.s.t. sw.
V_1—6AG7 tube
V_2, V_3—807 tube
V_4—5Z3 tube
V_5—5R4 tube
V_6, V_7—VR105 tube

Complete schematic diagram of the 150-watt universal r.f. amplifier unit.

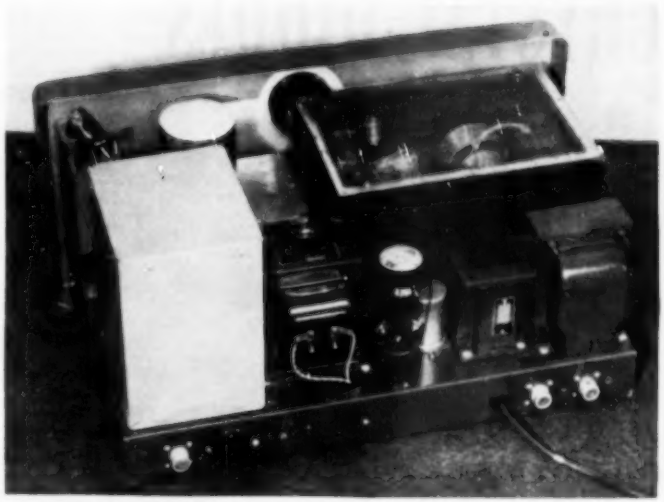
advantages than the ability to amplify modulated signals. The harmonic content of the class B stage (even without push-pull connection) is lower than in a class C stage, an important consideration in reducing TVI. Also, the class B stage amplifies a keyed c.w. signal without acting as a pulse-sharpener and key click generator. A keying jack on the front panel is arranged to key the cathode of the class A driver stage and the keying is truly beautiful. Parasitic chokes are used in both grid and plate leads of the final amplifier tubes rendering them completely stable on all bands, key up or key down.

The 6AG7 driver is operated in rather unorthodox style. The tube is neutralized, not to prevent self-oscillation which is virtually impossible under the operating conditions, but to reduce the strength of the backwave radiated when the key is up. The neutralization condenser is merely a piece of well-insulated hook-up wire connected to the stator plate of C_5 and brought near or wrapped around the grid terminal of the tube socket. This adjustment may be made before the 6AG7 subassembly is mounted on the chassis. While listening to the signal in a receiver with an exciter driving the 6AG7 and all voltages applied to the 6AG7, *but with the keying circuit open*, the capacity of the hook-up wire condenser is varied by moving it closer to the grid terminal by means of an insulated stick. As the neutralized point is passed, a definite null will be noticed

in the receiver. The wire should be secured in this position and the adjustment is complete. L_5 and C_1 form the one resonant trap in the unit. They are tuned to approximately 58 mc. to reduce the harmonic output of the 6AG7 in this region. If a grid dip meter is available it may be used to trim this coil and condenser combination to resonance at this frequency, although this adjustment is not essential. Inverse feedback improves the stability of this stage due to the unbypassed cathode resistor, R_5, a further deterrent to oscillation or parasitics in the 6AG7 stage. This type of inverse feedback has the effect of increasing the output impedance of the tube which is undesirable in driving a class B amplifier. To stabilize the load on the 6AG7 and compensate for this increased plate impedance, a resistor may be shunted across L_5. The value of this resistor should be chosen so that the 807's will be fully driven (to 300 ma. or so off-resonance plate current) with the r.f. gain control about three-quarters on. The value of this resistor will vary from about 15,000 ohms on 80 meters to about 50,000 ohms on 20 meters and will probably not be needed on ten meters at all where circuit losses will replace it. Suitable resistors may be mounted on the coils and changed with the coils.

The r.f. gain control is a carbon potentiometer of about 50 ohms which terminates the coaxial cable from the exciter. This resistor dissipates all the driving power supplied by the exciter since the 6AG7 requires only voltage drive. R_5, therefore, functions as the r.f. gain or excitation control and is a continuously variable transmitter power control so that the output may be set at any desired value from zero to the full power capability. Since the exciter cable is always terminated in its characteristic impedance, no reflections from the amplifier occur with the result that amplifier tuning adjustments are completely separate from the exciter tuning. A change in the length of the coaxial interconnecting cable between exciter and amplifier has absolutely no effect on the tuning of either. One watt of r.f. input will be more than enough on any band to completely excite the 6AG7. The r.f. gain potentiometer is mounted on a small plate of aluminum on the side of the small shield and is therefore outside the shield. C_7 connects the potentiometer arm to the grid of the 6AG7 through a feedthrough bushing in the shield. Break-in operation is not possible with this rig because the driver stage is keyed, but this seems to be the price that must be paid for perfect keying. The keying of the 6AG7 may be easily controlled by adding a small inductance in series with the key lead and a small capacity across the key, to produce any desired softness. Backwave radiation is undetectable a few hundred yards from the transmitter, thanks to the neutralization in the keyed stage.

(*Continued on page* 138)



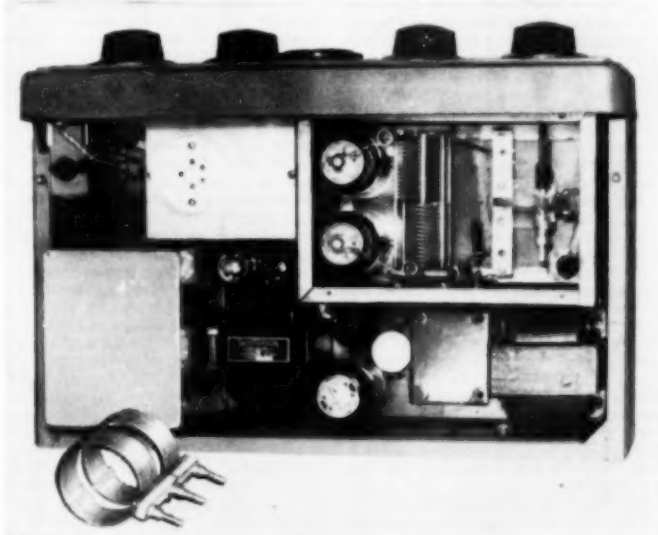
Rear chassis view. The r.f. input is to the coaxial connector on the left. The antenna and receiver connect to the two coax connectors on the right. The exciter power supply connections are made through the five-prong socket on chassis lip.

TYPE OF EXCITATION	807 TOTAL PLATE MA.	WATTS INPUT	APPROX. OUTPUT WATTS	PLATE MA. WITHOUT MODULATION
C.W.	240	180	100	60 (key-up)
FM	200	150	90	200
AM	120	90	30	120
SSSC	240 (on peaks)	180 (on peaks)	110 (on peaks)	60

Note: 807's: Plate—750 volts. Screen—300 volts. Bias Adjustment for 60 ma. total resting plate current.

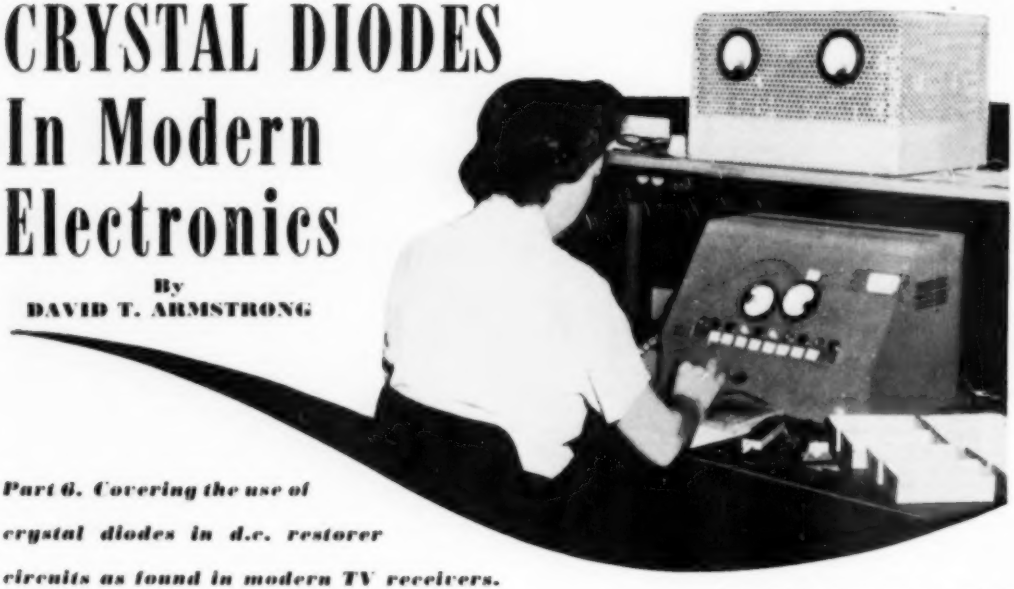
Table 1. Operating conditions for the 150 watt universal r.f. amplifier unit.

Top view. The copper screen wire shield has been removed to show interior of final amplifier compartment. The 6AG7 is mounted horizontally on small shield compartment.



CRYSTAL DIODES In Modern Electronics

By
DAVID T. ARMSTRONG



Part 6. Covering the use of crystal diodes in d.c. restorer circuits as found in modern TV receivers.

One of the test stages through which all diodes pass. This operation separates diodes into eight classifications according to forward and back resistance limits.

LAST month we noted in connection with the elimination of one-half the 6AL5 that there is a problem of eliminating the other half in some simple manner. Many design engineers have found it convenient to use a second germanium diode for d.c. restoration and thus eliminate the 6AL5 entirely from the circuit.

The function of the d.c. restorer is to re-establish the correct d.c. operating level of the video signal arriving at the picture tube grid in order to maintain a uniformity of background illumination in the picture. Capacity coupling of the video amplifier to the detector removes the d.c. level of the signal that was established at the transmitter. When a germanium diode is designed into a circuit as the peak rectifier in the grid circuit of the picture tube, as illustrated in Fig. 1, it will add a d.c. bias dependent upon the peak voltage of the synchronizing pulses and maintain the tips of these pulses at some fixed d.c. level. The operating point of the picture tube is then established by the brightness control.

In the absence of the germanium crystal diode, the video signal would vary about an a.c. axis. Inserting the diode into the circuit will permit the .05 mfd. condenser, C_1, to charge to a voltage proportional to the synchronizing pulse voltage; this adds a d.c. voltage to the video components and maintains a constant reference level.

In the operation of this circuit best performance will be obtained with a diode that has low forward resistance and high back resistance. We noted before that this is characteristic of diode crystals; when the back resistance is high the forward resistance is low. The *G-E* 1N65 or the *Sylvania* 1N55 and 1N58 are specifically adapted for this particular use. Because the forward dynamic resistance of germanium crystal diodes is lower than the forward dynamic resistance of vacuum tubes, there is the possibility of improvement in the performance of crystals over tubes in this application.

It should be borne in mind, however, that only those diodes selected for high back resistance will perform properly. For the *G-E* 1N65 it is recommended that a resistor of approximately ½ megohm be used in parallel with the diode to minimize the effect of variation of the back resistance between individual diodes in order to maintain uniform performance for all receivers on a given assembly line. The individual experimenter may ignore this for he will achieve the best d.c. restoration by securing a diode with a very high back resistance characteristic and low forward dynamic resistance.

As pointed out in the section on the video detector it is possible to use the d.c. component at the detector output to fix the light cut-off point of the picture tube at the blanking level. To achieve this it is necessary that d.c. coupling be used between the detector and the video amplifier as well as between the video amplifier and the control electrode of the picture tube. Since it is not always convenient to design a d.c. coupled amplifier, some other method of d.c. insertion is desirable. The use of the d.c. component at the detector output produces the best results, but it is possible to achieve good results with a special d.c. reinsertion diode.

The term "d.c. restoration" is applied to the circuit which sets the brightness level for any given scene. The average of the picture signal, which determines the average brightness, is the d.c. component; the signal variations are referred to as the a.c. component. Whenever the video signal must pass through coupling or blocking condensers, such as those present in typical *RC* video amplifiers, the d.c. component is lost; the entire signal is averaged around the a.c. axis. Blanking and sync pulses will not line up and the background lighting will be darker. It is the purpose of the d.c. restorer circuit to eliminate these defects. It does so by selecting, automatically, e i t h e r the blanking pedestal or the sync pulse level for use as a reference axis.

There are several methods of d.c. restoration. Among the more common are the grid leak restorer, the diode tube, and the germanium crystal. The grid leak restorer method is economical in that the amplifier tube is used as the diode; however, the results obtained with either a diode tube or germanium crystal are believed to be superior.

The presence of the d.c. component in the video signal makes it possible to distinguish between a black line on a gray field, and a gray line on a white field, although the a.c. component is exactly the same for both. Preservation of the d.c. component at the control element of the picture tube is essential if the transmitted scene is to be reproduced with the correct photographic gamma, contrast, and shading.

In the present standardized negative

system of transmission the black level corresponds to 75% modulation; the tips of the sync pulses extend to 100% and are what is known as "blacker than black." The camera signal usually lies between 15% modulation (maximum white), and 75% modulation (black level). Thus, d.c. reinsertion resolves itself into maintaining the blanking level contained in the transmitted signal at the light cut-off point (75% modulation, or black level) of the picture tube. Hence the camera signal components act against a fixed point in such a manner that their long time average level causes the over-all background illumination to vary in accordance with the background illumination of the transmitted scene. The d.c. reinserter reproduces accurately only those changes in video level which occur at a rate slower than approximately 50 cycles-per-second.

A reinsertion diode functions essentially as a peak detector with a long time constant load circuit. The condenser charges during the sync pulses and discharges into the load resistor during the line scanning interval. When operating conditions in a diode circuit are correct, not only is there d.c. reinsertion, but the tips of all the sync pulses are of the same amplitude, regardless of irregularities in the transmitted signal. This lining up of the tips of the sync pulses at the grid of the picture tube materially improves the operation of any sync separating circuit connected at this point. When d.c. reinsertion diode circuits are used this is the best point at which to connect the sync circuit.

Fig. 1 shows a typical d.c. reinsertion circuit. Here it is possible to substitute the crystal for the diode directly since the other component values remain the same for either crystal or diode. The ratio of the load resistor R_L to the diode resistance of the tube or crystal should be as large as possible because the larger the ratio the more constant the blanking level and the sync pulse amplitude. With a crystal this ratio is very good because the diode resistance is low. But the value of the load resistance may not usually be greater than one megohm because larger resistance values are apt to introduce gas current difficulties into a cathode-ray tube. For this reason, in order to obtain a high ratio of load to diode resistance, the diode should have as low a dynamic resistance as possible. This is one reason why a crystal is better than a vacuum tube for this application.

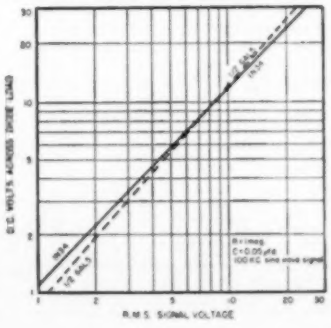
A comparative set of curves for a 1N34 crystal and one-half a 6AL5 are relatively the same for d.c. volts across the diode load plotted against rms signal voltage, see Fig. 2. With a one megohm load the rectification efficiencies for these components do not differ greatly. The crystal has a slightly greater output at low levels. Use of a germanium diode for d.c. reinsertion results in general over-all improvement of the circuit. This is due to the fact that the dynamic resistance of the diode is materially lower than the dynamic resistance of a vacuum tube. Further, with the crystal there is more secure clamp at the blanking level and more even alignment of the sync pulses.

The action of the circuit in Fig. 3A is as follows. With a positive-going signal on the plate of the video output amplifier the cathode of the diode becomes positive and passes no current. When the output signal swings negative, the cathode of the diode becomes negative and current flows through the diode and the 1 megohm resistor, R_L. This causes the cathode of the diode to become positive and condenser C_1 is charged. The positive voltage, determined by the signal, is applied through resistor R_1 to the grid of the picture tube. The one megohm load resistor for the diode is in series with the 100,000 ohm grid return resistor of the picture tube; therefore, any bias set up by the reinserter diode acts in conjunction with whatever grid bias is already present.

This positive voltage is added to the grid across resistance R_1 and, since it is proportional to the signal, the sync tips will be aligned and the d.c. component, or the average brightness, will be automatically restored to the picture. So that the average brightness of the picture will not change so rapidly as to affect the eyes, the time constant of C_1 and R_{1+2+3}, R_1 is made many times longer than the duration of one horizontal line, say 500 times, or approximately one frame. In this manner, scene lighting will be truthfully reproduced and extremely rapid changes making up the detail of the picture will be faithfully reproduced. Note that in this basic circuit the diode may be either ½ a 6AL5 or a germanium crystal such as the 1N34, 1N55, 1N58, or 1N65.

This is a difficult circuit to explain simply. Here is a slightly different approach to analysis of the functions of the separate components. With a positive-going signal on the plate of the video output amplifier, the cathode of the diode is positive and passes very little current. This small current, however, is sufficient to charge C_1 and C_2 eventually to the lowest plate voltage

Fig. 2. Curves showing d.c. reinserter operation, comparing a 1N34 with ½ of 6AL5.



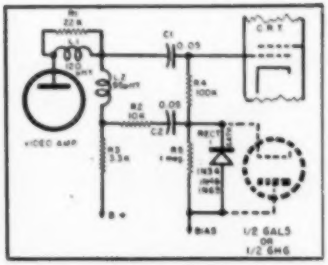


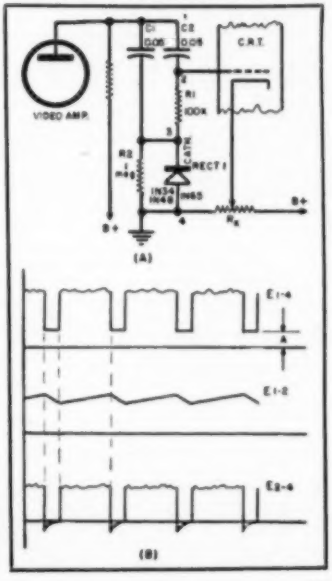
Fig. 1. A crystal d.c. restorer. The capacitive coupling, C_1, between the video amplifier and picture tube makes d.c. reinsertion necessary. The value of C_2 depends on the value of R_L since R_LC_2 has a time-constant relationship. The diode may be a crystal, ½ a 6H6 or ½ a 6AL5. R_L, the diode load resistance, is 1 to 2.2 megohms, depending on the crystal and gas current difficulties in picture tube.

(equal to the sync pulse tips) of the video output tube.

When the output signal swings negative to the height of the sync pulses, the cathode of the diode becomes negative and the diode conducts. Because the forward resistance of the diode is low, condensers C_1 and C_2 quickly discharge any extra charge accumulated during the positive voltage swing. The current through R_1 and the diode therefore quickly becomes zero, and hence the voltage applied to the picture tube grid during the sync pulses is always held at zero. The CRT bias is then set so that with zero input volt-

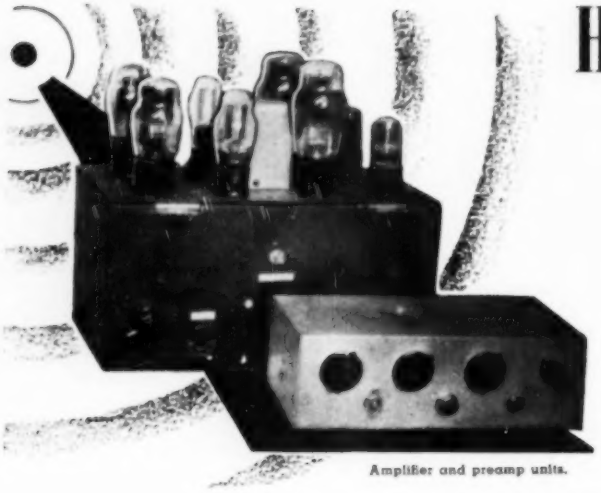
(*Continued on page 127*)

Fig. 3. Operation of a d.c. restorer. (B) Signal voltages which exist in (A). E_{1-4} represents the voltage across points 1 and 4 in the circuit, E_{1-2} across points 1 and 2, and E_{2-4} across points 2 and 4.



High Quality 50-WATT AMPLIFIER

In addition to amplifier unit, author covers construction of an accompanying preamplifier.



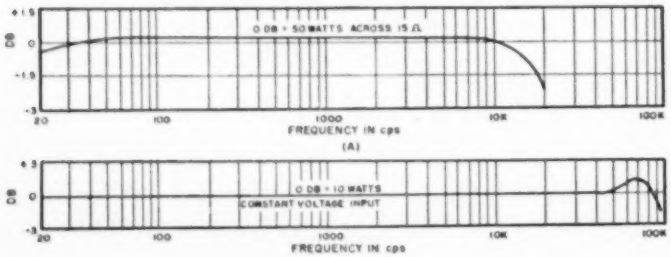
Amplifier and preamp units.

By
JAMES BAUMGARDNER

THE faithful reproduction of music places many stringent requirements on the equipment designed for this purpose. In particular, the audio amplifier must be capable of meeting certain definite specifications. An ideal amplifier for driving a loudspeaker may be characterized as follows: It should supply ample power to the load at any frenquency in the audible range with negligible distortion and uniform gain, and should have a low internal impedance to provide good damping of the loudspeaker cone. To further qualify these statements, the audible range can be set at from 20 to 20,000 cps, and the gain should be sufficient to provide full power output from the currently available sources of high quality program material, such as low level magnetic phonograph pickups and tape playback heads, and FM tuners. Negligible distortion is not as easy to qualify, due to discrepancies in test procedures and methods of rating amplifier output and distortion. The usual procedure is to rate the power output for a total harmonic content of 5% at a frequency of 400 or 1000 cps. With most amplifiers, however, this is the point of maximum output and minimum distortion. The ratings do not usually specify the amount of power available or the distortion percentages at the extremes of frequency where it is most difficult to obtain high power with low distortion. One of the notable exceptions to this is the *McIntosh* unit, which delivers full rated power at any frequency within the above mentioned range with low distortion.[1] To accomplish this, however, special output and interstage coupling transformers are required which are costly and not available to the individual builder.

The purpose of the design to be described in this article was to obtain as nearly an ideal unit as possible using standard components. It is based on the principle of obtaining the maximum power possible from a given power supply so as to insure low distortion at moderate power levels. An efficiency of 50% was required in the power amplifier with a power input of 100 watts available, providing 50 watts output. It should be pointed out that this power output is taken to mean the power that can be delivered to a load placed across the secondary of the output transformer and includes losses from this source. This efficiency dictates the use of a push-pull class AB power stage employing tetrodes, while the requirement for low internal resistance indicates the use of negative voltage feedback. Accordingly, it was decided to use two 6L6 beam tetrodes in the output circuit, operating with a plate voltage of 450 v., screen voltage of 300 v., and a grid bias of –30 v. To insure adequate grid driving signal at low distortion, a push-pull cathode follower is direct-coupled to the 6L6 grids. A separate negative power supply of about –80 v. supplies fixed bias for the output stage and the cathode-follower driver. To keep the d.c. resistance in the 6L6 grid circuits to a minimum, a center-tapped coil is used as the cathode follower load. Plate voltage for the driver as well as the 6L6 screen voltage is regulated at 300 v. by the use of two VR150 voltage regulator tubes connected in series. The cathode follower is driven by a split load phase inverter using one half of a 6SL7. Adequate output voltage swing is insured by the fact that this stage operates into the high impedance of the cathode follower input and further by virtue of the high plate supply voltage made available to this stage by the circuit arrangement. The grid and cathode resistors for this section of the 6SL7 are returned to the negative supply voltage, while the plate load resistor is connected to 420 volts. The remaining section of the 6SL7 is operated as a straightforward voltage amplifier and completes the basic circuit. To provide 20 db of negative feedback, the 16 ohm output winding of the output transformer is connected through a suitable resistor to the cathode of the first section of the 6SL7. With this

(A) This curve shows the maximum power output across a 15 ohm resistive load without departure from the sine wave as a function of frequency. (B) The frequency response of the high quality 50-watt amplifier at 10 watts output.



amount of feedback, about 8 volts signal is required at the input grid to provide full output.

Several features of the circuit outlined combine to place severe demands on the output coupling transformer. The requirement for a relatively large amount of feedback means that the output transformer should have minimum phase shift in order to avoid instability at the extremes of frequency. Good primary-to-secondary efficiency is required to provide 50 watts output with a minimum of coupling loss. Leakage inductance must be small to minimize distortion caused by switching of the plate current from one half of the primary to the other—an inevitable condition of class AB operation.[2] An investigation of the various transformers available disclosed that the *Stancor* A-8050 series appeared to be the most promising. The A-8053 unit was tried and has proved very satisfactory.

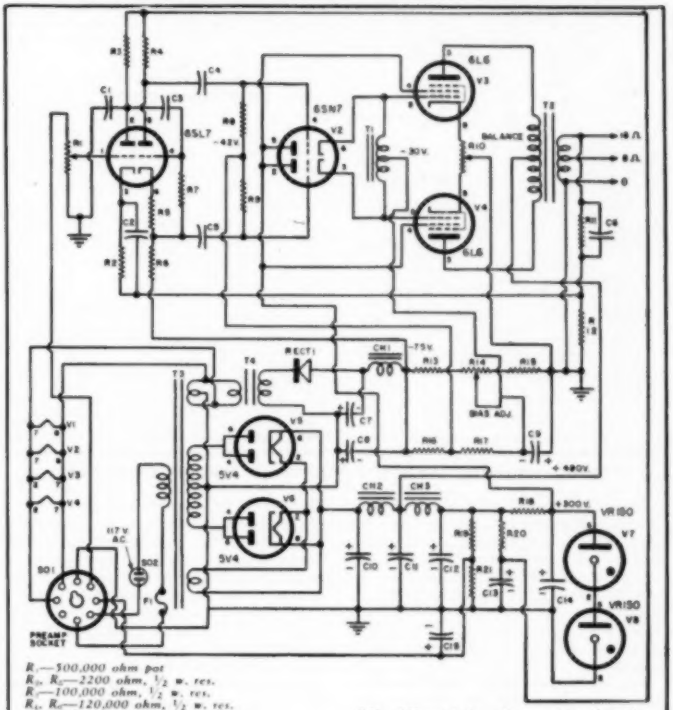
The preamplifier designed for use with this circuit employs three miniature duo-triodes. The first is used as a preamp for magnetic pickups, tape playback, and microphone input. Feedback equalization is used to provide bass-boost for the two former functions, while the latter is arranged to provide flat response. Suitable switching of components in the feedback circuit is accomplished by a section of the input selector switch. Either a 12AX7 or a 12AY7 may be used in this position, the latter providing somewhat lower noise and less microphonics. The second duo-triode is a straight two-stage amplifier with the tone controls in the plate circuit of the first stage. In the units built so far, 12AX7 tubes have been used for this position. With the gain thus provided, however, considerable attenuation of high level inputs (FM, etc.) as well as some attenuation of phono inputs is necessary to bring them down to the level of the tape input with the particular tape playback head used. Output level data is not readily available on tape heads, and there is considerable variation among the units on the market. If a tape input is not required, a 12AU7 may be substituted for the 12AX7 in this second position, leaving ample gain for magnetic phono pickups and tuner inputs. No circuit value changes are necessary. The third duo-triode has its two sections in parallel and serves as a conventional cathode follower. Either a 12AX7 or 12AU7 may be used in this position. If the cable to the main amplifier is over 20 feet in length, or is of excessively high capacity, a 12AT7 may be used to provide somewhat lower impedance to drive the higher capacity. The latter tube has a higher mutual conductance and will, therefore, provide a lower output impedance when used as a cathode follower. A step-type equalized volume control is employed to assure proper tonal balance at low volume levels. The pots connected to the various input jacks should be adjusted to provide the same volume level from all of the input positions on the selector switch.

The tone controls are arranged to give independent boost or attenuation of lows and highs. The bass control varies the level at 40 cps from −18 to plus 16 db, while the treble control changes the 10 kc. response from −14 db to plus 16 db, all relative to the response at 1000 cycles. The theory of operation of these controls has been described elsewhere.[3]

To provide for feeding the selected program source to a tape recorder amplifier, a jack is connected to the input terminal of the volume control and may be connected to any high impedance recording amplifier input. Since the level at this jack is not affected by the setting of the volume control, the amplifier may be used for monitoring at any desired volume level while recording proceeds.

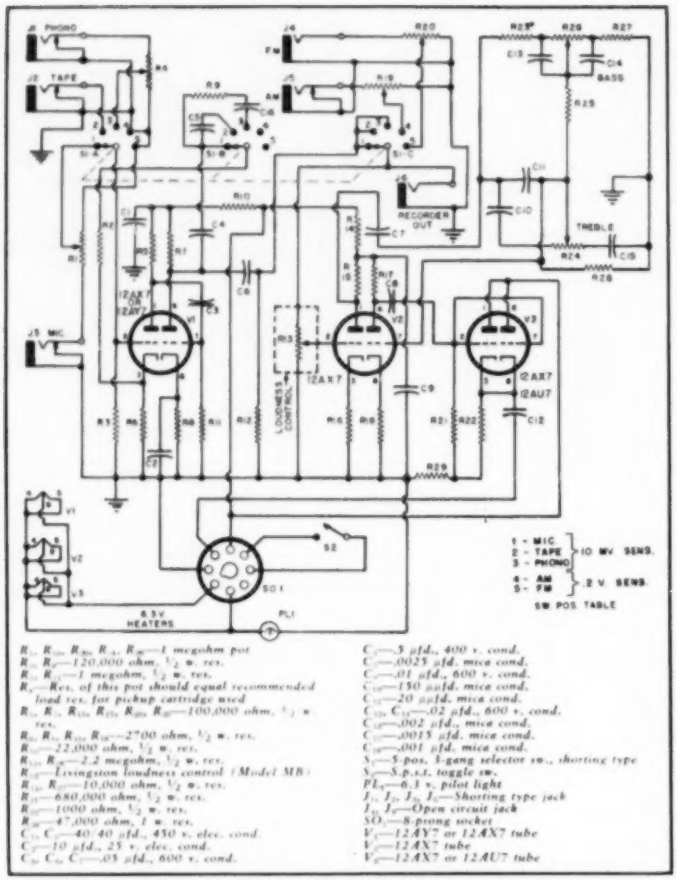
As may be seen in the photographs of the unit, the main amplifier and power supply are housed in a 6" x 7" x 12" metal cabinet, with all transformers, except the input coil, mounted inside. The top of the cabinet, containing the tube sockets and the input coil, is hinged at the rear for easy access to all components. The preamplifier is built in a 3" x 5" x 9½" chassis with controls along the front drop and tube recess, and input connections as well as power cable connection on the rear drop. The compact construction thus obtained makes the preamplifier easy to mount in cabinets with a minimum of space requirements.

Complete wiring diagram and parts list for the 50-watt amplifier. Although the author used push-pull 6L6's in the output stage, 807's could be substituted. It may be advantageous to do so in view of the fact that 807's have higher ratings.



R₁—500,000 ohm pot
R₂, R₅—2200 ohm, ½ w. res.
R₃—100,000 ohm, ½ w. res.
R₄, R₆—120,000 ohm, ½ w. res.
R₇, R₈, R₉—1 megohm, ½ w. res.
R₁₀—30 ohm, 5 w. wirewound pot
R₁₁—2500 ohm, ½ w. res.
R₁₂—820 ohm, ½ w. res.
R₁₃—1500 ohm, 5 w. res.
R₁₄—1000 ohm, 5 w. wirewound pot
R₁₅—500 ohm, 5 w. res.
R₁₆—68,000 ohm, ½ w. res.
R₁₇—10,000 ohm, ½ w. res.
R₁₈—2500 ohm, 20 w. wirewound res.
R₁₉—15,000 ohm, 2 w. res.
R₂₀—10,000 ohm, ½ w. res.
R₂₁—100,000 ohm, 2 w. res.
C₁—100 μμfd. mica cond.
C₂—25 μfd., 25 v. elec. cond.
C₃—.05 μfd., 600 v. cond.
C₄, C₇—.1 μfd., 600 v. cond.
C₆—500 μμfd. mica cond.
C₈, C₉—50 μfd., 150 v. elec. cond.
C₁₀—50 μfd., 50 v. elec. cond.
C₁₁, C₁₂—16 μfd., 600 v. elec. cond.
C₁₃, C₁₄—20 μfd., 450 v. elec. cond.
C₁₅—8 μfd., 450 v. elec. cond.

CH₁, CH₂—3.5 hy., 50 ma., 200 ohm filter choke (Stancor C-1080 or equiv.)
CH₃—4 hy., 250 ma., 60 ohm filter choke (Stancor C-1412 or equiv.)
T₁—Output trans. push-pull plates, 4000 to 14,000 ohms to v.c., primary only used. (Stancor A-3823 or equiv.)
T₂—Output trans. 5000 ohm pri., 8, 16 ohm sec. push-pull 6L6's. (Stancor A-8053 or equiv.)
T₃—Power trans. 400-0-400 v. @ 250 ma.; 5 v. @ 4 amps; 6.3 v. c.t. @ 3 amps. (Stancor PC-8413 or equiv.)
T₄—Fil. trans. 6.3 v. @ 3 amps. (Stancor P-3014 or equiv.)
SO₁—Octal socket
SO₂—117 v. power line socket
F₁—3 amp. line fuse
Rect.—75 ma. selenium rectifier
V₁—6SL7 tube
V₂—6SN7 tube
V₃, V₄—6L6 tube
V₅, V₆—5V4 tube *V₇, V₈—VR150 tube*



R_1, R_{13}, R_{20}, R_{21}, R_{26}—1 megohm pot
R_2, R_{14}—120,000 ohm, ½ w. res.
R_3, R_{15}—1 megohm, ½ w. res.
R_4—Res. of this pot should equal recommended load res. for pickup cartridge used
R_5, R_{16}, R_{23}, R_{25}, R_{27}, R_{28}—100,000 ohm, ½ w. res.
R_6, R_{17}, R_{22}, R_{24}—2700 ohm, ½ w. res.
R_7—22,000 ohm, ½ w. res.
R_8, R_{19}—2.2 megohm, ½ w. res.
R_9—Lixington loudness control (Model MB)
R_{10}, R_{29}—10,000 ohm, ½ w. res.
R_{11}—680,000 ohm, ½ w. res.
R_{12}—1000 ohm, ½ w. res.
R_{18}—47,000 ohm, 1 w. res.
C_1, C_{12}—40-40 μfd., 450 v. elec. cond.
C_2—10 μfd., 25 v. elec. cond.
C_3, C_{10}, C_{11}—.05 μfd., 600 v. cond.
C_4—.5 μfd., 400 v. cond.
C_5—.0025 μfd. mica cond.
C_6—.01 μfd., 600 v. cond.
C_7—150 μμfd. mica cond.
C_8—20 μμfd. mica cond.
C_9, C_{13}—.02 μfd., 600 v. cond.
C_{14}—.002 μfd., mica cond.
C_{15}—.0015 μfd. mica cond.
C_{16}—.001 μfd. mica cond.
S_1—5-pos. 3-gang selector sw., shorting type
S_2—S.p.s.t. toggle sw.
PL_1—6.3 v. pilot light
J_1, J_2, J_3, J_6—Shorting type jack
J_4, J_5—Open circuit jack
SO_1—8-prong socket
V_1—12AV7 or 12AX7 tube
V_2—12AX7 tube
V_3—12AX7 or 12AU7 tube

Wiring diagram and parts list covering the preamplifier used with 50-watt amplifier.

Since the photographs were taken, a row of ¼ inch diameter holes has been added near the top of the cabinet containing the amplifier. Small rubber feet have also been placed on the bottom of the unit, with several holes cut in the bottom. This gives a chimney effect and aids materially in cooling the power transformer and other components.

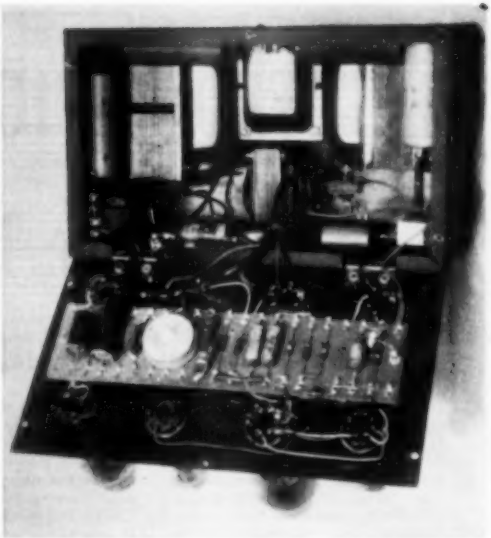
The circuit described was carefully checked for performance. Preliminary measurements were made of power output, frequency response, total harmonic content at various output levels and at various frequencies, linearity between input and output signals, and damping factor. The maximum power output depends upon the full-load power supply voltage, which, in turn, depends on the line voltage. Measurements were made at a line voltage of 114 v. At 400 cycles, the maximum power output is 50 watts at 1% total harmonic content. The same is true at 40 cps, while at 50 watts output at 10,000 cps the total distortion is about 3%. At an output level of eight watts, the frequency response is flat from 20 cps to 50 kilocycles. No departure from linearity is observed up to 50 watts output, using either sine wave input or music. Square wave tests indicate that the circuit is free from ringing or overshoot. Several units built thus far have displayed no instability due to the feedback loop, even with the secondary winding of the output transformer unloaded. The effective internal resistance measured at the 16 ohm output terminals is 1.5 ohms, providing a damping factor of 10. This measurement was made at 40, 400, and 10,000 cps with the same result. The zero signal plate current of the two 6L6's is about 60 ma., providing a plate dissipation of 15 watts per tube. At 50 watts output, the total plate current is 180 ma., plus 20 ma. of screen current, providing a total input power of 86 watts. This represents an efficiency of 58%, while the plate dissipation at full output is only 18 watts per tube.

Perhaps the most significant of the tests made were the listening tests in which the amplifier was used to drive a high quality speaker system and was supplied with live FM programs and the best available LP and tape recordings. Initial listening tests quickly indicated that the quality was excellent at all volume levels up to the maximum that could be handled by the particular speaker system employed (25 watts). Therefore, a comparative test was set up in which two amplifiers could be bridged to the same input line and their outputs fed to a selector switch connected to the speaker system so that instantaneous switchover from one amplifier to the other could be accomplished. With the volume controls of the two units set to provide the same volume level, it was then possible to compare the two units directly. In all cases one of the amplifiers was the one described here, while the other was one of several high quality units selected for comparison on the basis of excellence of published data and popularity. Among them was the *Williamson* unit and another highly regarded circuit using push-pull 6B4G triodes in class A. Results showed that at low and moderate volume levels there was no detectable difference when switching from one unit to the other. At higher volumes, however, the difference was marked, particularly at low frequencies where considerable power peaks are encountered. The clean, solid reproduction of the circuit described at high volume levels is remarkable and is only possible where relatively large reserves of sine wave handling power are available. The speaker system used for the tests consisted of a *Stevens* two-way reproducer employing a 15" cone woofer and a coaxially mounted multicellular high frequency horn, with electrical crossover at 1200 cps. This unit is mounted in a corner type enclosure employing horn loading of the low frequency cone to provide response down to 40 cycles.

While considerable attention has been given recently to the problem of transient or "switching" distortion caused by leakage inductance in the output transformer when class AB operation is employed, it does not appear to be too serious when high quality output transformers are used. In the circuit described, this effect is observable as a notch in the sine wave as can be seen at either plate of the output stage, occurring at relatively high output levels and at frequencies above about 8 kc. It should be noted, however, that this distortion must become very severe before there is any noticeable departure from a sine wave in the combined signal as observed at the secondary winding of the output transformer. This may be noted by the photograph showing the output waveform at 50 watts and 10 kc. It should also be noted that frequencies of this order are not found in music except as harmonics and overtones which are considerably down in power from the average level. Listening tests indicate that the quality of reproduction depends to a far greater extent upon the ability



Over-all view of the high quality 50-watt amplifier. The power supply and main amplifier are housed in a 6" x 7" x 12" metal cabinet. All transformers, except the input coil, are mounted inside the cabinet. In later models the author added a row of cooling vents at the top and bottom of the housing.



Internal view of the main amplifier-power supply cabinet. By using a hinged-type cabinet easy access to all component parts is provided, making any changes and servicing easy to handle.

of the amplifier to deliver full power with low distortion at low frequencies than at extremely high frequencies, and this is borne out by tests showing linearity between input and output signals of an amplifier handling music at high power levels.

Some readers may question the need for a fifty watt amplifier for home use. Although many tests have shown that the majority of home listening is done at an average level of one-tenth of a watt, the peak passages can be as high as forty watts, even though this is an instantaneous figure.

Amplifiers of ten watt rating can give very satisfactory performance in the majority of listening tests, but it is the few occasions when the peak power of the amplifier is exceeded, where the reserve power of this amplifier tends to separate the men from the boys.

If the full benefit is to be derived from this amplifier, a speaker system to handle the peak power must be used. Unfortunately, good speaker systems to handle fifty watts are rather expensive, but in any event it is advisable to buy the best you can afford.

In selecting a speaker system from the catalogues, remember that the majority of manufacturers rate their speakers at the maximum power they can handle without serious distortion and the music will sound much cleaner if the speaker is not pushed to its limit.

If the optimum results are desired, it is advisable to use a speaker system or a group of speakers having a power rating equal to the maximum output of the amplifier, or fifty watts.

Another factor that must be considered in a high quality installation is the proper speaker enclosure. Many different types of speaker enclosures have been designed, and all have certain advantages.

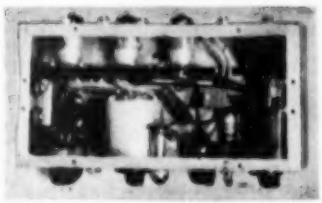
Speaker enclosures of various types have been described in past issues of this and other magazines.

The room acoustics will also have a considerable bearing on the ultimate results, and due consideration should be given to this factor in judging any sound system. The only fair way to compare systems is under identical room conditions.

Other mechanical arrangements will undoubtedly suggest themselves to the constructor; but in any event it is desirable to take every precaution to avoid hum by the use of a single ground bus to which all ground returns are made. This precaution, more than any other, will eliminate hum.

In the event that there is objectionable hum when all precautions are taken, this can frequently be reduced or eliminated by careful selection of tubes in the preamplifier portion.

To sum up, this design represents an opposite approach to the problem of designing a high quality music amplifier from that used in the *Williamson* circuit, in which tubes having comparable power ratings are used with a similar power supply to provide less than one third the useful power output. The circuit is not complex, and



Bottom view of the preamplifier chassis. Unit is built on a 3" x 5" x 9½" chassis.

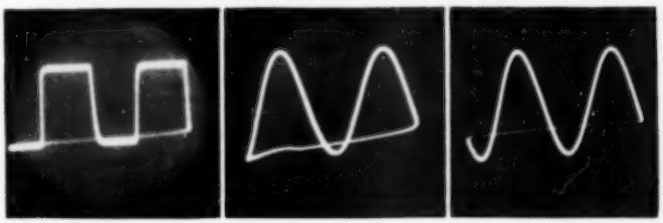
the components are relatively inexpensive. The most costly single item is the output transformer, which can be purchased for less than $12. Several units using this circuit have been built, and all have proved highly satisfactory, more than justifying the effort that has gone into the design, construction, and testing of this amplifier.

REFERENCES

1. *McIntosh, Frank H. and Gow, Gordon J.: "New 50-Watt Amplifier Circuit," Audio Engineering, Dec., 1949.*
2. *Sah, A. P.: Quasi-Transients in Class B Audio Frequency Amplifiers," Proc. IRE, Nov., 1938.*
3. *Sterling, Howard T.: "Flexible Dual Control System," Audio Engineering, Feb., 1949.*

—30—

Scope patterns. (Left) 25 watt output, 2 kc. square wave. (Center) 50 watt output at 10 kc. with 15 ohm resistive load. (Right) 50 watt output at 40 cps with 15 ohm load.



ELECTROSTATIC FOCUS For Picture Tubes

By
WALTER H. BUCHSBAUM
Author, "Television Servicing"

Born of necessity, this new focusing system is, in most cases, equal or better than old method.

IN MOST 1952 TV receivers one familiar major component is missing. Most of the new picture tubes operate without a focus coil or PM focusing ring. Although this important device is omitted, focus on the screen will be excellent, much better in many instances than with the conventional magnetic focusing system. Starting January 1st, all major picture tube manufacturers have swung over to the new, electrostatic focus type tube.

Born of the impending shortage of copper and cobalt for magnetic devices, the use of electrostatic focus is an important stride towards simplifying TV receivers. The old type focus coil used about 3 pounds of copper and at least 100 ma. of d.c. to focus the picture sharply. A large wattage potentiometer and some series resistors were needed to provide focusing adjustment. The position of the focus coil on the neck of the picture tube was fairly critical, requiring an elaborate set of brackets, mounting bolts, etc. The PM type of focusing ring did not use any current from the receiver, but its adjustment was often tricky and mounting it required special brackets. The PM material, usually a high grade of Alnico, used cobalt which is one of the most critically needed materials in our defense effort. All these expensive and cumbersome features are eliminated in the newest electrostatic focus tubes. Small screen picture tubes and most oscilloscope cathode-ray tubes have always used electrostatic focusing, but until the beginning of 1951 it had not been considered practical to apply the same system to large picture tubes. In small cathode-ray tubes the accelerating anode serves as the focusing element, but for present day large screen picture tubes a separate element in the electron gun does the focusing. The first electrostatically focused picture tubes designed in early 1951 used a focusing potential of 3000 to 5000 volts and are referred to as high voltage focus tubes. A later model used no external focusing voltage but employed an internal connection from the focus element to the cathode. The most widely used type is really a compromise design which allows for small errors in gun structure and variations in the voltages in the TV receiver. This last type is called a low voltage focus tube. Before discussing the merits and application of each of these three types of picture tubes a short description of the operation of an electrostatically focused tube seems to be in order.

Principle of Electrostatic Focus

Five separate elements make up the electron gun inside the picture tube. The filaments heat the cathode so that its coated surface will emit electrons. The control grid surrounds the cathode with a negative field, reducing the number of electrons that can travel towards the anode. Placed next to the cathode-grid structure is the accelerating anode, often called the accelerating grid because its function is similar to that of the screen grid in a pentode amplifier. The accelerating grid, G_2, is at a fixed positive voltage and it helps to keep the electron beam constant during slight variations in second anode voltage. The second anode contains the highest potential, usually over 10 kv., and is the final goal of the electrons after they have bounced off the screen. Aside from deflecting the electron beam to "paint" a raster on the screen, a focusing device is required to concentrate the electrons into one small spot on the screen. In magnetic focusing systems the electrons enter a magnetic field at a certain angle and are deflected by this field to converge in one spot on the screen. This magnetic field is at right angles to the center of the electron path and only those electrons in the center of the beam cross the field at a right angle and therefore are not deflected. All other electrons enter at some other angle and are then deflected so as to hit the screen close to the center.

A system of electrostatic focusing is shown in Fig. 1. In addition to the elements listed in the preceding paragraph the focusing element is now part of the electron gun structure. Instead of a magnetic field the electrostatic field between two elements of different potential is used to converge the electron beam. The focus element and the second anode in Fig. 1 have a potential difference between them just as two opposite charges in electrical theory. One, the focus element, has a negative potential and the other a high positive potential. Between these two potentials electrostatic lines of force exist. These lines vary in both density and in force as shown in Fig. 2. Any electron passing in the center will not be affected in its path, but those electrons entering the field at some angle will be forced back towards the center of the field. That, in principle, is the operation of electrostatic focusing or any other electron lens.

As we see in Fig. 1, the electron gun structure really contains two separate electronic lenses. The first is the field between the control grid and G_2. The second is the field between the focus anode and the second anode. The first lens is relatively fixed although, on close observation, it is apparent that the focus and the spot size change with changes in control grid voltage. In a picture the bright portions of a single line will appear thicker than the darker parts and this is due to the variation in the voltage difference in the first lens, control grid, and G_2. The second lens is adjusted by varying either of the two voltages. Since it would not be practical to vary the second anode voltage, the potential on the focusing element is adjusted. It might be pointed out right here that no substantial change in focus is obtained by this method, simply because, compared to the 12 kv. of the second anode, a 400 volt change in the focus element does not greatly change the electrostatic field between the two elements.

In actual operation the voltages between cathode, control grid, and G_2 are the most critical ones. Once they are adjusted, slight variations in focus or second anode voltage will have little effect on the electron beam and it would be possible to set them all to a fixed potential. Unfortunately it is not economical to mass-produce picture

tubes so accurately that the spacing of all the elements in the electron gun is held to zero tolerances. Voltages may vary in TV receivers, even among identical models. For this reason most of the new electrostatic tubes permit some adjustment of the focusing voltage. It is apparent from the electron optics presented here that the spacing, especially of the focus anode, is quite critical. Electrically, a high potential difference exists between the focus anode and the second anode, but the actual metal sleeves are placed fairly close together and are mounted on the same ceramic sleeve which holds all other elements together. The major difficulty with earlier models was the arc-over from the focus anode to the second anode through the mounting sleeve. This has now been overcome by placing glass beads at the most likely arc-over points. The limitation of arcing still remains, however, and none of the low voltage focus tubes can be operated at more than 16 kv. If this is exceeded, internal arcing is likely to occur.

Of the three types of electrostatically focused picture tubes only the low voltage and zero voltage focus tubes are easily used in place of an old style magnetic focus picture tube. The HV focus tubes require a focus voltage which is approximately 22% of the second anode voltage. For a 12 kv. second anode voltage the focus voltage must be about 3 kv., with some adjustment provided. Several different TV receivers made in 1951 are using this HV focus type picture tube with special circuits and parts to obtain and vary the focusing potential.

HV Focus Picture Tubes

The 17GP4 and the 21DP4 are both HV focus tubes having a rectangular metal shell and are most widely used in the 1951 *RCA* TV receivers. Other HV focus types are the 17FP4A, 20GP4, and 20FP4, all rectangular glass picture tubes. The focusing anode is brought out at the kinescope socket on pin #6, which is an isolated pin, not found in any of the magnetic focus type tubes. The socket used for these tubes must be a circular one and the inexpensive half round type used in many older receivers cannot be used. Since the voltage on pin #6 will be about 3 kv. a HV insulation wire must be used.

Fig. 3A shows a simple but effective circuit for obtaining focusing voltage for a HV focus tube. In this circuit, which is used in the *RCA* and some other sets, the high positive pulse on the plate of the horizontal output tube is applied to the plate of an additional HV rectifier, usually a miniature type like the 1V2 or the 1X2. A second filament loop for this rectifier is wrapped around the flyback transformer core. The output of this rectifier is usually about 4500 volts d.c. which is reduced through a bleeder network to the desired focusing voltage. The focusing control forms part of the bleeder network and a 500 $\mu\mu$fd. HV condenser

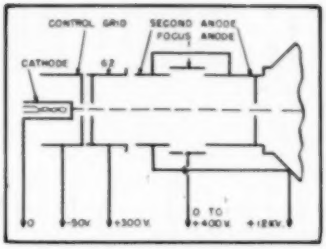


Fig. 1. Detailed plan of an electron gun for a low-voltage electrostatic focus tube.

provides the filtering action. Conventional potentiometers have a grounded case and shaft and are not designed to withstand several thousand volts from the resistance element to the case. To give adequate focusing range a bleeder of about 25-30 megohms is used with the focus control ranging to about 15 megohms. A special potentiometer was developed for this purpose, featuring a molded plastic case and insulated shaft and having a diameter of almost 2 inches.

In the *RCA* models featuring HV focus the entire circuit is mounted inside the HV compartment with the focus control shaft protruding at the rear of the chassis. This elaborate system eliminates the focus coil or focusing magnet, but provides no economy because the additional tube, condenser, and resistors add up to as much as the conventional focus coil. Since it was found practical to manufacture low voltage focus tubes by mass production, HV focusing has been largely abandoned in favor of the former method.

Low or Fixed Voltage Focusing

Compare the circuit in Fig. 3A with the circuit in Fig. 3B, and the advantages of low voltage focus tubes will be obvious. All that is required is a conventional potentiometer of about 1 megohm, ½ watt which costs only a few cents. The "B plus" voltage available in the TV receiver and the cathode voltage of the picture tube are important factors but in almost all present TV sets correct focusing voltage can be obtained. Before going into details on low voltage focus the difference between it and fixed or zero voltage focusing merits attention. The latter type requires extreme accuracy in manufacturing, and shrinkage among this type is quite high. As a result the cost of a zero focus tube is over a dollar more at the manufacturer's level than a low voltage focus tube. The price of a potentiometer and wiring often is less than the additional cost of a zero voltage tube. In addition, the zero voltage types will not give good focus if any of the other voltages on the picture tube are off by more than about 5%. For these reasons many TV manufacturers have swung over to the low voltage focus tubes. The only zero voltage types available, which require no adjustment at all and have no external connection for the focus element, are the 17KP4, 20JP4, and 21KP4, all rectangular glass picture tubes.

As mentioned before, different TV receivers use different voltage values in their "B plus" supply and when it is desired to replace an old magnetic focus type with a low voltage focus tube, the correct voltages and the right tube type must be chosen. Table 1 shows various values commonly found in present TV models. The second anode voltages are measured with respect to chassis, but all other voltages are with respect to the cathode of the picture tube. If the cathode receives the picture signal it is frequently at the potential of the video amplifier plate which will be slightly lower than the video amplifier "B plus" supply and the cathode voltage will vary with the picture signal. In this instance the value of the cathode voltage should be taken as half way between the zero and maximum signal value. From Table 1, it appears that occasionally a "B plus" higher than the

(*Continued on page* 130)

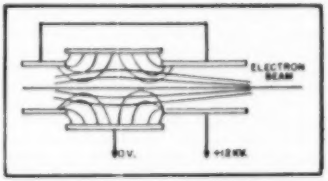
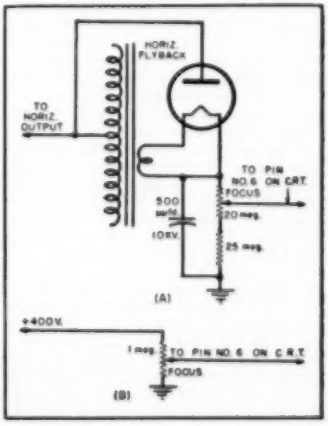


Fig. 2. Symbolizing an electrostatic lens.

	17HP4 or 20HP4	17RP4 or 20LP4
Second Anode	11-13 kv. 13-14 kv.	10-12 kv. 13-14 kv.
G_2	300 300-420	250-300 300-420
First Anode	200 - 300 100 - 150	0 ± 100 0 ± 400

Table 1. Voltage range of most TV models.

Fig. 3. Diagram of (A) high voltage and (B) low voltage electrostatic focus control.



INTERLACING TROUBLES and VERTICAL SYNC CIRCUITS

By
JOHN K. FRIEBORN

The causes of interlacing troubles, methods of tracing them, and details on improved vertical separator which is impervious to such troubles.

INTERLACING troubles and their correction are becoming more important to the technician than they once were. Imperfect interlacing has always existed to some extent on most receivers, but it is not particularly noticeable on small picture tubes. With larger picture tubes becoming common, set owners are more likely to be aware of it.

This article will examine interlacing problems more thoroughly than is usually done in general treatments of synchronization. In particular, it will show how imperfect interlacing may occur even with a normal signal being obtained from the integrator, suggest means of identifying and tracing faults, and bring to the reader's attention several circuits which avoid the faults of the integrator as a vertical sync separator.

The general nature of interlacing and the part played by the integrator and the equalizing pulses have been discussed in many books and magazine articles (for example, the articles in RADIO & TELEVISION NEWS by Solomon Heller and Peter Orne, "Servicing TV Sync Circuits," August and September 1950, and "Servicing Intersync Circuits," March 1951). This discussion of principles is intended to supplement such treatments.

On the television picture, the basic effect of interlacing is to double the number of scanning lines which would otherwise appear. That it does this can be verified by switching from a raster to a picture while keeping approximately the same horizontal and vertical scanning frequencies. For reasons which are explained in standard textbooks, if a saw-tooth oscillator is synchronized by a direct application of sync pulses, the free-running frequency is equal to or less than the synchronized frequency, but not greater. On the other hand, a saw-tooth oscillator controlled by flywheel synchronization (also called automatic frequency control) has about the same frequency when controlled as it has free-running. In most receivers the horizontal oscillator has flywheel sync while the vertical is directly synchronized. Therefore, in making the check mentioned, the vertical oscillator must be specially adjusted to have a frequency of about 60 cycles on the raster as it does on the picture, but it probably will not be necessary to take any precautions with regard to the horizontal oscillator.

The most convenient method of adjusting the vertical oscillator to a free-running frequency of 60 cycles-per-second is to set the vertical hold control for a normal picture, readjust it so the picture rolls downward (frequency higher than 60 cycles), then turn the control back just enough to make the picture stationary again (frequency just 60 cycles). With the vertical hold control adjusted, adjust the other controls on the receiver to obtain an unsynchronized raster and count the scanning lines in one inch or half an inch. Readjust the controls to obtain a picture and count the number of lines in the same space. It may be found that by moving the vertical hold control very slightly the number of lines and the spacing between them can be changed, without causing the picture to roll. The proper adjustment is for the greatest number of lines, spaced as nearly equally as possible. If the number of lines on the picture cannot be made twice as great as on the raster, interlacing is not being accomplished in the receiver and the experiment should be repeated on another set.

The reason for twice as many lines appearing on the picture is that the horizontal and vertical frequencies are maintained in the ratio of 262.5 to 1, so that the lines of each field are scanned half-way between those of the previous field and the last two fields scanned are visible simultaneously at any given time. On the raster there is nothing to keep the two frequencies in exactly that ratio, but there will be a tendency for the vertical oscillator to be triggered at the end of a line on every field by a horizontal retrace pulse coupled to the vertical circuit. The ratio between the two frequencies will, therefore, be a whole number, each field being scanned over the previous one, and only the last field scanned will be visible at one time.

If the interlacing is not perfect, that is, the ratio of the horizontal and vertical frequencies is not always 262.5 to 1 and the fields are alternately longer and shorter than normal, lines in one field will be shifted up or down with respect to the lines in the other field. Instead of the spaces between lines being equal, they will be alternately large and small. In an extreme case, complete loss of interlacing, the fields are alternately longer and shorter than normal by a sufficient amount to cause the lines of one field to be superimposed upon the other.

If the scanning lines are not equally spaced, but overlap more or less, there is obviously a loss of vertical resolution. There are fewer separate horizontal lines, so fewer changes in brightness are possible from top to bottom of the picture. It is less obvious, but equally true, that imperfect interlacing may cause a loss of horizontal resolution. This may be seen by considering what would happen in the special case where a dark spot followed by a bright one along a line in one field were directly above a bright spot followed by a dark one along a line in the other field. If the two lines became superimposed, a line would result in which the two spots were each a combination of bright and dark spots, that is, the two spots would be of about the same brightness, so that both of the original brightness changes along the individual lines would be lost.

Imperfect Interlacing

Many things can disturb the synchronizing of the vertical oscillator, such as: misadjustment of the vertical hold control; faulty components or improper applied d.c. voltages in the vertical oscillator circuit changing the free-running frequency so much that it cannot be corrected by the hold control; distortion of the video signal before sync separation by overloading in an amplifier stage causing clipping and reduction of sync pulse amplitude, or by loss of low frequencies so that the vertical oscillator can be triggered by the blanking pulse instead of the synchronizing signal; hum due to heater-cathode leakage in a vertical deflection, sync, or video channel tube, or to insufficient power supply filtering; picture signal interference due to a fault in the sync separator over-

loading in the video channel, or coupling between sections of the receiver through the power supply or by stray fields; noise interference due to a fault in the sync limiter or vertical separator circuits, or unwanted coupling; horizontal sync interference due to fault in vertical separator, or unwanted coupling; horizontal deflection signal interference due to coupling through the low voltage power supply, by stray fields, or in the case of receivers in which the vertical oscillator plate voltage is obtained from the damper tube, by signal coupling between the two tubes through the d.c. wiring; audio interference due to unwanted coupling or microphonics, that is, vibration of a microphonic tube or other component in the vertical deflection of sync channel by sound waves from the speaker; and finally, weak signal, which is not a cause in itself, but may allow any of the other factors mentioned to have a more noticeable effect than they would have in the presence of a normal signal. The specific type of vertical synchronizing fault, loss of interlacing, however, can be caused only by interference from horizontal synchronizing or deflection signals, although a slight amount of such interference may produce a more noticeable effect when the vertical synchronizing signal is weak or clipped or the vertical hold control is misadjusted.

Tracing Path Interference

General loss of vertical synchronizing may often be corrected by such simple means as tube substitution, but the quickest method of correcting imperfect interlacing begins with finding the path of the interference into the vertical oscillator, using an oscilloscope. The sync pulse input to the oscillator may be observed with the receiver tuned to a station, but with the vertical oscillator disabled so that pulses produced by it will not confuse the oscilloscope pattern. If horizontal sync interference is seen as a ripple on the vertical sync pulse, it would of course indicate trouble in the integrator or other vertical separator.

Next, the plate voltage of the vertical oscillator can be examined, with the oscillator disabled, for the presence of horizontal signals, with and without a station tuned in, and with and without the horizontal circuits operating, to determine whether the interference is due to horizontal synchronizing or deflection signals. When the source of the interference has been determined, the appropriate components can be checked.

Integrator Circuits

In some makes and models of television receivers, imperfect interlacing is found which cannot be corrected by any ordinary servicing operation. The cause may be a slight amount of stray coupling or coupling through the power supply or damper, with its effect magnified by the fundamental defect of the integrator as a vertical sync separator.

An integrator is a low pass filter with a cut-off frequency somewhere between 60 and 15,750 cycles, so as to pass the vertical sync signals, and reject the horizontal. However, no filter has a perfectly sharp cut-off, so that one which reduces signals of 15,750 cycles almost to zero will also reduce those of 60 cycles somewhat. Furthermore, the vertical signal, being a pulse, contains high harmonics of 60 cycles which will be attenuated even more than the fundamental, so the shape of the output will be different from that of the input. The best compromise between rejection of the horizontal signal and retention of the shape of the vertical is obtained with a sharp cut-off filter, so most receivers use a three-stage *RC* filter. More stages of shorter time constant would give the same size vertical pulse with better shape and less horizontal interference, but three stages is the usual limit. At any rate, reducing the amount of horizontal interference applied to the vertical oscillator grid will not reduce the effect of horizontal interference entering the vertical circuit by other paths, and no integrator can produce an output pulse as sharp as the input.

Since the output voltage of the integrator does not change very rapidly, the voltage applied to the vertical oscillator grid is about the same value for a considerable period of time before and after the exact instant of triggering. Triggering takes place when the bias and sync signal combined become less negative than cut-off bias for the tube used and the plate voltage applied. If the required cut-off bias was changed slightly, the time of triggering could be changed considerably. This would occur if the vertical oscillator plate voltage was changed by a pulse from the horizontal section. On one field a horizontal pulse would come at the beginning of the vertical sync pulse, on the other it would be a half line after the beginning of the vertical pulse.

Fig. 1 shows the effect on vertical synchronizing of irregularities at the grid and plate. Fig. 1A is a conventional waveshape of grid voltage on the discharge tube. Fig. 1B is an enlargement of the part of the cycle in a circle, around the time of triggering, showing the effect of a variation in the amplitude of the sync pulse. Fig. 1C shows the effect of ripple on the

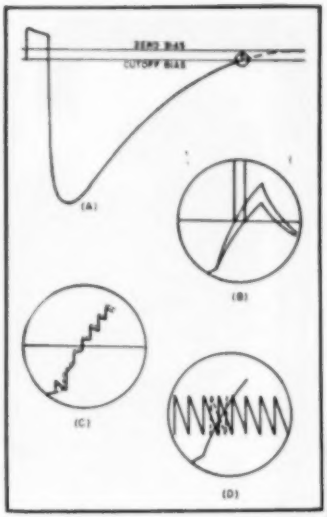


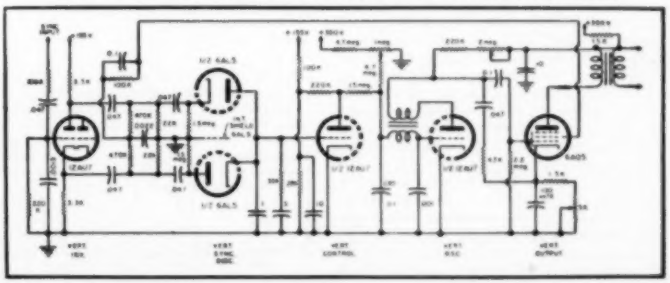
Fig. 1. Grid voltage waveforms in saw-tooth oscillators. See text for complete details.

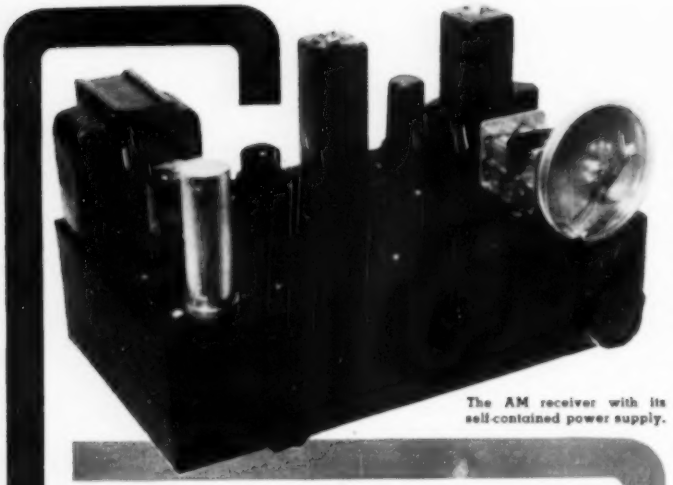
sync pulse, due to horizontal sync pulses, the solid and dashed lines representing two successive fields. Fig. 1D shows the effect of ripple in the plate voltage due to horizontal pulses, changing the cut-off bias of the tube.

Accuracy of vertical synchronization with an integrator can be improved by the use of an effective sync pulse limiter before it and by thorough decoupling of the vertical oscillator from its plate voltage supply and careful placement of parts and wiring. If all practical means along these lines prove insufficient, it may be necessary to replace the integrator by another type of vertical sync separator. It is not a part of ordinary servicing to redesign a receiver, because such work is seldom necessary and usually not worthwhile financially. Improvement of a receiver, of course, should not be undertaken by anyone not competent to restore it to the point where its performance is the best possible within the limits of its design. However, improvements in receivers may be made by competent technicians under appropriate circumstances and several cir-

(*Continued on page* 152)

Fig. 2. The vertical deflection circuit used in the Radio Craftsmen Model RC-100.





The AM receiver with its self-contained power supply.

A DUAL-CHANNEL AM RECEIVER

By
GLEN SOUTHWORTH

Designed specifically for reception of high quality musical programs—this receiver is a conventional superheterodyne employing two separate i.f. channels. One channel has high gain and good selectivity for distant stations while the other has low gain and broad tuning for local reception.

A NUMBER of characteristics are desirable in broadcast band receiving equipment designed to be used primarily for the reception of high quality musical programs. Among the most important of these is the ability of the equipment to accurately reproduce the full range of audio frequencies present in the transmitted signal. Similarly, unwanted distortions of the audio envelope should not be introduced in the high frequency or detector portions of the receiver. Of like importance is the ability of the set to discriminate against interference from stations other than the one tuned in, the ability to reduce static and atmospheric disturbances, and the presence of a low noise level inherent in the receiver's own circuits.

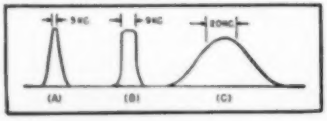
The audio frequency response of a receiver is most frequently determined by the selective tuned circuits of the radio frequency and intermediate frequency stages. In conventional, sharply peaked, superheterodyne receivers, this may mean a high frequency roll-off commencing at about one or two thousand cycles, with consequent adverse effect in the quality of even those broadcast stations limiting their modulation ranges to about five thousand cycles. This loss of high frequency intelligence may be compensated in three ways; the use of audio equalization to restore attenuated highs, the use of fewer tuned circuits in the path of the signal, and the broadening of the response of the tuned circuits in the receiver, either by stagger tuning or by lowering the effective "Q" of the coils through use of shunting resistances.

Although great interest has been shown recently in the reduction of harmonic and other distortions to a very low level in equipment designed to handle audio frequencies, a similar interest hasn't developed in the design of equipment for the amplification and detection of modulated radio frequencies. Probably the most important potential sources of audio distortion in the conventional AM receiver are the last intermediate frequency amplifier stage and the diode detector. The combination of these two factors may tend to produce a receiver with a distortion vs input signal level similar to that shown in Fig. 2. At low signal intensities the contact potential developed by a thermionic type of diode, such as the 6H6, may cause the detector to fail to fully rectify the incoming signal, with resultant distortion or even failure to detect very weak signals. At high input signal intensities, such as produced by local stations, the last or even the preceding i.f. stages may be overloaded, thus producing a limiting action which may greatly distort the modulation envelope and result in poor audio quality.

Distortion in the tuner circuits may occur in a variety of other ways. These include misalignment, unwanted regeneration in the i.f. or r.f. circuits, hum or noise modulation of the signal by the receiver elements, and the presence of serious non-linearity in the high frequency amplifier stages. In addition, sometimes serious problems may be encountered due to the use of certain types of associated audio equipment, notably power amplifiers, in which case ultrasonic feedback may occur between the audio system and the tuner input. Distortions of this nature may be produced due to high frequency parasitic oscillations in the amplifier output stages (in the case of either triodes or beam power tubes), however it might be noted that the 455 kc. intermediate frequency of the conventional superheterodyne may feed through to the input of the first stage of the audio amplifier and care should be taken to filter out stray radio frequency components from the amplifier input.

Adjacent channel interference and excessive noise or static can mar the enjoyment of the program being received, and both are closely related to the selectivity of the receiver. Fig. 1 shows typical selectivity curves for three different types of tuners: the sharply peaked superheterodyne, the stagger-tuned superheterodyne, and the t.r.f. The more selective the receiver, the greater its ability to reject unwanted adjacent signals. Similarly, the greater the selectivity of the receiver, the greater is the ratio between the response to the peak amplitude of random noise compared to the response to a continuous carrier frequency. Unfortunately, both superior selectivity and consequent improved

Fig. 1. Selectivity curves for different types of receivers. (A) Sharply peaked superheterodyne. (B) Stagger-tuned superhet. (C) Tuned radio frequency or t.r.f receiver. The width of the top of the curve determines the h.f. response of receiver.



signal-to-noise ratio are accompanied by the attenuation or loss of the higher audio frequencies impressed upon the carrier.

In general, the requirements of a good receiver indicate a system with high gain and good selectivity for the reception of distant stations, where interference rejection and noise reduction are of great importance, while for the reception of local stations capable of overriding both interference and noise a broadly tuned receiver of low gain is desirable in order to reproduce the full range of modulation frequencies with minimum distortion. A number of solutions to these requirements have been devised, including superheterodynes with variably selective i.f. circuits and the use of two separate tuners, one a broad tuning t.r.f. and the other a sharply peaked superheterodyne. A simple and uncomplicated design, favored by the author, uses a conventional superheterodyne circuit employing two separate intermediate frequency channels. One of these consists of four tuned i.f. coils and provides a highly selective branch of the circuit. The other channel consists of only two i.f. coils in combination with a untuned amplifier stage, and the coils of this channel may be loaded by means of parallel resistances to provide additional broad tuning.

A circuit diagram of a two-channel tuner is shown in the schematic and is such that a conventional receiver may be easily adapted, providing sufficient chassis space is available for the additional components. Alignment procedure is relatively simple and consists of placing a d.c. voltmeter across the second detector diode load, R_{20}, which is fed by the high selectivity channel and adjusting the four tuned i.f. circuits for maximum deflection of the meter. This process aligns both channels simultaneously and makes it possible to switch from the high selectivity channel to the low selectivity channel without the necessity of retuning the set. The alignment process may then be completed by adjusting the oscillator trimmer condenser for proper high frequency tracking and the antenna coil trimmer for correct resonance at about 1400 kc.

A number of slight variations from conventional practice are found in the tuner circuit. Among these is the use of lower than normal filament voltage on the heater of the 6H6 dual diode in order to reduce possible unwanted cathode emission. The i.f. coil in the plate circuit of the 6SA7 mixer tube is shunted by a 75,000 ohm resistor in order to broaden the tuning slightly and to reduce noise and instability which might occur in the circuit. No automatic volume control is used in the design for two reasons. The first reason is that most circuits of this nature cause the direct current resistance in the amplifier grid circuits to be on the order of several megohms and can aggravate the tendency of the tubes to gas up, with resultant instability. Likewise, a.v.c. voltage may tend to aggravate distortion occurring in the last i.f. amplifier stage when a strong signal is being received and it is generally more desirable to reduce the effective length of the antenna than to depend upon a.v.c. action. However, if desired, a.v.c. voltage may be easily obtained from the detector output of the sharply tuned channel and applied to the preceding stages. It should be noted though, that this will cause a sudden decrease in audio output from the broadly tuned channel at the point of exact resonance.

An alternate form of second detector, known as the "infinite impedance" type, is illustrated. This type of detector has good characteristics and loads the associated radio frequency circuits to a lesser degree than the diode detector, however, it is more susceptible to overload from strong signals and a.v.c. voltage is not easily derived from it. With either type of detector it was considered desirable to use a separate detector for each channel in order to minimize switching complexity and prevent possible pops or clicks which might result from switching other portions of the circuit.

In constructing the tuner, the main precaution to be taken is to insure good shielding and separation of circuits carrying high frequency voltages. Leads should be kept as short as practical, and it should be noted that ground loops are often as serious a problem in r.f. circuitry as in audio construction. The writer prefers to use a separate ground system, when practical, with the various shields con-

(*Continued on page 90*)

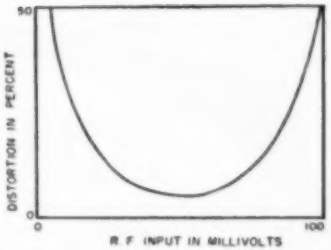


Fig. 2. Typical distortion vs input signal intensity of a receiver. Large amounts of audio distortion occur on either very weak or very strong signals.

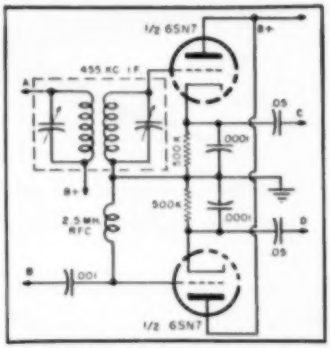
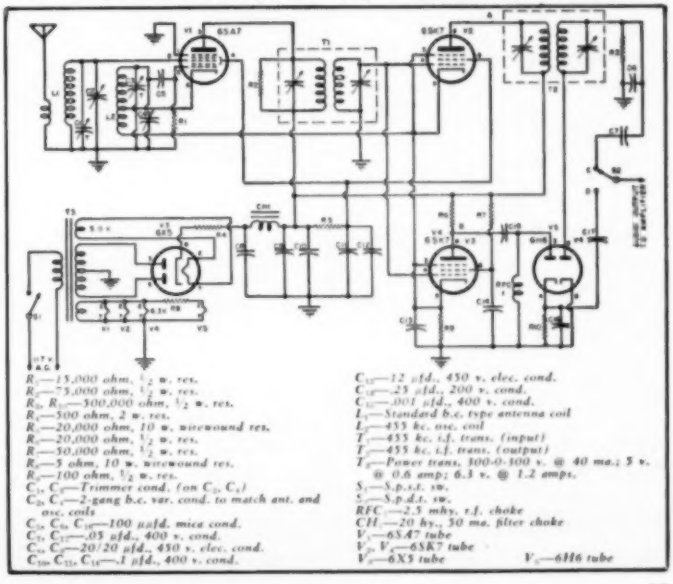


Fig. 3. Alternate form of second detector that may be used in the tuner circuit. Terminals A, B, C, and D connect to corresponding terminals shown in diagram of Fig. 4.

Fig. 4. Diagram of two-channel receiver. A loop antenna may be used in place of antenna coil shown. Note that the 6H6 heater is operating below its normal 6.3 v. This is done to minimize spurious cathode emission under no-signal conditions. The 6X5 is operated at a lower heater voltage because the power transformer used had a separate 5 volt winding. The 6X5 may be operated at 6.3 volts if desired.



R_1—15,000 ohm, ½ w. res.
R_2—75,000 ohm, ½ w. res.
R_3, R_{15}—500,000 ohm, ½ w. res.
R_4—500 ohm, 2 w. res.
R_5—20,000 ohm, 10 w. wirewound res.
R_6—20,000 ohm, ½ w. res.
R_7—50,000 ohm, ½ w. res.
R_8—5 ohm, 10 w. wirewound res.
R_9—100 ohm, ½ w. res.
C_1, C_2—Trimmer cond. (on C_3, C_4)
C_3, C_4—2-gang b.c. var. cond. to match ant. and osc. coils
C_5, C_6, C_{16}—100 µµfd. mica cond.
C_7, C_{17}—.05 µfd., 400 v. cond.
C_8, C_9—20/20 µfd., 450 v. elec. cond.
C_{10}, C_{13}, C_{15}—.1 µfd., 400 v. cond.
C_{12}—12 µfd., 450 v. elec. cond.
C_{14}—.25 µfd., 200 v. cond.
C_{18}—.001 µfd., 400 v. cond.
L_1—Standard b.c. type antenna coil
L_2—455 kc. osc. coil
T_1—455 kc. i.f. trans. (input)
T_2—455 kc. i.f. trans. (output)
T_3—Power trans. 300-0-300 v. @ 40 ma.; 5 v. @ 0.6 amp; 6.3 v. @ 1.2 amps.
S_1—S.p.s.t. sw.
S_2—S.p.d.t. sw.
RFC—2.5 mhy. r.f. choke
CH.—20 hy., 50 ma. filter choke
V_1—6SA7 tube
V_2, V_3—6SK7 tube
V_4—6X5 tube
V_5—6H6 tube

SATURABLE REACTORS

By
ERWIN LEVEY

Details on a saturable reactor that can be quickly assembled using two standard power transformers.

THE operating principles of saturable reactors have been known for quite a long time, but it is only within the past few years that these units have come into general use. Considering the reactor's versatility, the number of ways in which it can be used is almost unlimited. Basically it is a magnetic device which functions as a variable inductance. It has a d.c. winding which is used for control and an a.c. winding which is connected in series with the load to be controlled. There is no direct connection between the two circuits, the only linkage is through the magnetic properties of the core on which they are both wound.

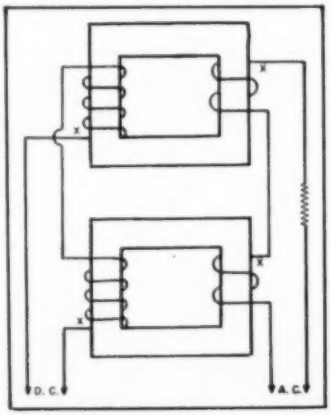
Operation is based on the phenomenon that the permeability of a magnetic material is not constant. It varies with the strength of the magnetizing force applied. Since the inductance of a coil is directly proportional to the permeability of its core material, it also will vary. When the d.c. control current is zero the permeability of the core is extremely high, therefore the inductance of the a.c. coils is large. Since they are connected in series with the load the load current is extremely low. As the d.c. control current is increased the magnetizing force through the core is increased. This causes the permeability and therefore the inductance of the a.c. coils to decrease. This, in turn, means that the load current will also increase.

As the d.c. current increases further the inductance is proportionately decreased with a corresponding increase in load current. When the core is fully saturated with full d.c. current the inductance of the a.c. coils is minimum. Therefore it can be seen that the control effect is secured by means of d.c. core saturation. Since the d.c. power required for control is less than the a.c. power used in the load circuit the unit has a certain amount of gain or amplification.

Physically a saturable reactor has the same general type of construction as a transformer although several different types of core arrangements are possible. The one described here is extremely simple and is assembled by using only two standard transformers.

Fig. 5 is a photograph of a unit which was assembled breadboard style for ease of construction. The two small transformers on the left are used as the saturable reactor, the small motor being the controlled unit. The chassis on the right is the variable d.c. power supply used for control purposes. Fig. 4 gives a close-up of the reactor unit alone, from which it can be seen that the transformer windings are connected to a screw-type terminal strip. This procedure facilitates connections and requires only a screwdriver for assembly.

Fig. 1. Terminal connections of saturable reactor using two separate transformer cores.



Before proceeding further, several terms which identify multiple coil connections will be explained in order to clarify the main explanation to follow. In a "series-aiding" connection two coils are connected together so that their relative winding directions are the same. The net result is that the voltage induced in each is in the same direction, while the total terminal voltage equals the sum of the two individual voltages. In a "series-opposing" connection the two coils are connected so that the relative winding directions are opposite, producing voltages in opposite directions. Here the total terminal voltage is equal to the difference of the two individual voltages. It is important to note that these relative winding directions are given from an electrical viewpoint, and not in terms of the actual physical windings as they are placed on the core.

Terminals of similar polarity or winding direction are indicated by means of an *X*. This end is called the "start," the other end is the "finish." The conventions that will be used throughout this article are illustrated in Fig. 3, which also shows the proper type of parallel connection. To avoid confusion they are defined specifically at this point.

As pointed out earlier in the article several different types of core arrangements are possible. The one which will be explained here as the basis for the unit to be constructed is the simplest type from an experimental viewpoint. A schematic of the unit is shown in Fig. 1.

Two separate, identical cores are used, each having a d.c. and an a.c. winding. Both a.c. windings are identical, so are both d.c. windings. However, the d.c. windings differ in physical characteristics from the a.c. windings. Since each d.c. coil is on a core with an a.c. winding there will be an a.c. voltage induced in the d.c. windings due to transformer action. Now, if the two d.c. coils are connected in series-opposing, the a.c. voltage induced in each will cancel, as a result of their being equal in magnitude but opposite in polarity. This is the only permissible connection for the d.c. coils. But the series-aiding connection for the a.c. coils, as shown in the diagram, is only one of the possible connections for them. The unit to be described here is based on this type of arrangement, as explained before.

For this purpose, two identical 40 ma. power transformers were used, each having the following windings: primary (117 v.), high voltage (480 v.), 5 v. filament, and 6.3 v. filament. All the secondaries had center taps but they were taped up since they were not used. Actually, for the construc-

tion of a simple unit only the primary and high voltage windings are needed but the low voltage windings can be used to show some further interesting control possibilities. The primary is used as the a.c. coil and the high voltage winding as the d.c. coil.

Once the transformers and terminal strips have been mounted the windings are connected in the following order: primary, high voltage, 6.3 v. filament, and 5 v. filament. The order is the same for each transformer. At this point actual physical order of the two leads of a particular winding do not matter.

The next and most important step is to properly phase all the windings, that is, to determine their winding directions with respect to the primary as the standard. The procedure will be explained first for transformer #1 separately. Since the primary is used as the starting point the connection to the first terminal is called the start, the second connection, the finish.

Connect the finish of the primary to the high voltage lead immediately adjacent to it. Then connect the primary leads to 117 volts and read the voltage appearing across the two coils which are now in series. If the reading is the sum of the two individual voltages the coils are connected in series-aiding, this being the condition desired and indicating that the high voltage leads are in the proper physical order. On the other hand, if the difference of the two voltages is indicated, the connection is series-opposing. If this is the case, reverse the positions of the high voltage leads and repeat the test. The reading will then indicate a series-aiding connection. For each set of winding leads, the first one in physical order should be the start; the second, the finish. If low voltage windings are present repeat the procedure exactly as described using the primary and each winding individually. The complete procedure should be repeated step-by-step for the windings of transformer #2.

The purpose of this test can be seen by referring to the schematic diagram in Fig. 2. The windings are laid out in standard order to facilitate the actual interconnection of the units as a saturable reactor. This is the most crucial step in the whole procedure and a double check should be made to make sure that no errors exist. Otherwise the unit will either operate improperly or not at all.

As explained previously, the d.c. coils (high voltage windings) must be connected in series-opposing. Following the original definition this is done by connecting the finish of high voltage #1 to the finish of high voltage #2. The d.c. voltage source is then connected to the two remaining leads, which are the start of high voltage #1 and high voltage #2. In this simple arrangement the unit is not polarity sensitive, that is, the positive lead could be connected to either end. However, to keep a standard procedure (necessary for later arrangements), start high voltage #1 will be designated the plus terminal and start high voltage #2 the negative terminal. Next, the two a.c. coils (primaries) are to be connected in series-aiding. Therefore connect finish of primary #1 to start of primary #2. These coils are then connected in series with the load to be controlled. The actual schematic of this set-up is shown in Fig. 6A.

At this point it is necessary to determine the range of the unit. The size of the wire in the primary windings (a.c. coils) is determined by the power (actually current) used under actual load conditions for which the transformer was originally designed. This is done in the following manner: Total secondary power equals power of each individual winding.

HV—480 v. x .04 amps.	19.20 watts
6.3 v.—6.3 v. x 2 amps.	12.6 watts
5 v.—5 v. x 2 amps.	10 watts
Total	41.8 watts

The assumption will be made that this is the same as the input power. This is not exactly true in the case of an actual transformer but it is found that the assumption is close enough to give an idea of the range, which is all that is necessary. Thus it is shown that 40 watts is the limit due to the physical properties of the unit. The actual amount of power that can be controlled is somewhat less, approximately 30 watts. From experimental results it was found that the d.c. current necessary for complete control when the high voltage windings are used as the d.c. coils was equal to the current rating of

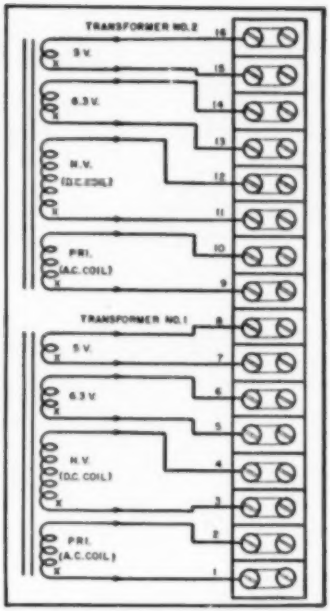


Fig. 2. Transformer winding connections.

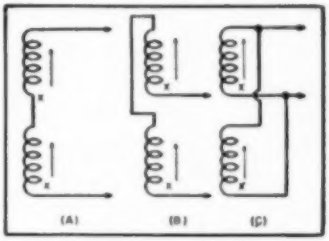


Fig. 3. Coil connections. (A) series-aiding, (B) series-opposing, and (C) parallel.

the high voltage windings plus 10% of that amount, in this particular case, 44 ma. The unit used for control was a regular variable power supply rated at 300 volts with no load. It is best to use a

(*Continued on page* 150)

Fig. 4. Close-up of reactor. Two small transformers are used.

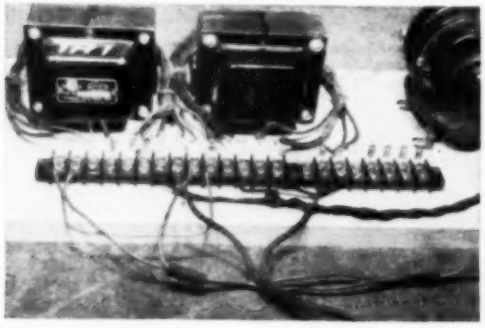
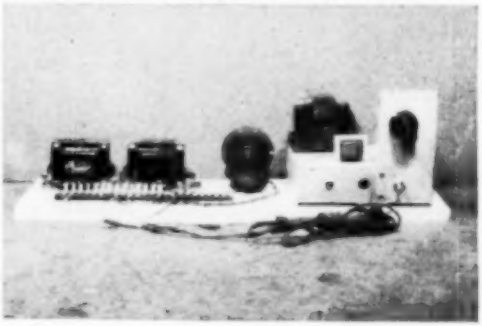


Fig. 5. Breadboard assembly of saturable reactor motor control.



Mac's RADIO SERVICE SHOP

By JOHN T. FRYE



"ALL WORK AND NO PLAY . . ."

BARNEY stood looking out of the window of Mac's Radio Service Shop at the big fat snowflakes just starting to drift down from the dark sky overhead.

"Is this winter going to last forever?" he asked morosely as he walked back into the service department. "I don't think I ever had such a bad attack of winter willies before."

Mac glanced up questioningly from the TV chassis on which he was working and then said quickly, "Know exactly how you feel, Red, for I feel the same way myself. Guess we need a little vacation of some kind."

"I've got proof I need a vacation," Barney said with a ghost of his old grin. "The other morning I was using a test pattern to adjust the focus on a TV set when suddenly the pattern was cut off and a program started in which Dagmar was a visiting celebrity. For a few minutes I was actually *mad* because the test pattern had disappeared! Now any old time a red-blooded American boy like me would rather look at the curves of a test pattern than those of Dagmar—well, there can be no doubt but that he needs a vacation from service work!"

"You are so right!" Mac agreed with a chuckle. "We really have been hitting the ball pretty hard here in the shop this past six months; but I do not think the amount of work we have been doing is altogether to blame for this sudden I'm-fed-up-to-here feeling that we both have. Part of the trouble comes from the *way* we have been working. When you first started here, we did a lot of talking as we worked because I was trying to teach you as much as I could as we went along. Then you reached the point where I wanted you to gain self-confidence by licking the problems all by yourself, and we quit talking. Whole hours go by now without our saying a word to each other."

"I know it," Barney quickly replied, "and it is not near as much fun as it used to be. I'm gaining self-confidence, all right, but I certainly miss talking over the sets with you and having you give me heck for overlooking something that is obvious or giving me a pat on the back when I pull a bright one."

"I miss our chatter, too," Mac confessed; "and I can tell you now that you would be astonished if you knew how often your prying questions prodded me into seeing what was wrong with the set when my mind was a complete blank just before your question nudged me in the right direction."

"Well okay then!" Barney exclaimed. "Let's stop 'holding Quaker meeting' and go back to the good old days. You can start right now by telling me what makes this set whistle so loudly on 910 kilocycles. It works all OK on the rest of the band, but it makes so much fuss on the University station on that one frequency that you can't listen to it."

Mac flipped over the complaint card attached to the set and glanced at it. "Hm-m-m," he hm-m-med, "says here the customer never noticed the trouble until after he had the phono jack installed on the back. Does that tell you anything, Sherlock?"

Barney looked as blank as Laurie Anders of "The Wide Open Spaces" fame.

"What's half of 910?" Mac asked.

"455, but what's that—say, that's about the i.f. frequency."

"And the phono jack is probably connected across the volume control, which, in turn, is connected to the diode plate circuit of the second detector. At the same time the jack is very near the loop antenna that is resonated to whatever station is being received. When we tune to 910 kc., the strong field about the loop is connected through the lead from the jack directly to the diode plate circuit. Here it mixes with the second harmonic of the i.f. frequency and produces the strong heterodyne whistle as the two slightly-different frequencies are combined by the rectifying action of the diode. The process is exactly the same as is used when you employ a beat frequency oscillator for receiving c.w. stations, except in that case the b.f.o. is fixed-tuned to about the i.f. fundamental frequency and is loosely coupled to the diode circuit so that it produces a whistle on every station received."

"That's the cause; what's the cure?" Barney wanted to know.

"There are several different ways you can go at correcting the trouble. The main thing is to reduce the coupling between the loop antenna and the second detector diode plate circuit. An r.f. choke in the lead from the phono jack to the volume control would do this, or you might try shielding this lead and moving the jack down into the corner of the back cover so it will be as far as possible from the field of the loop. In general, if you want to avoid birdies in the set, it is a good idea to avoid increasing the possibility of direct pickup by any circuit carrying the i.f. frequency. That's what the person who installed the phono jack forgot when he tied that long lead to the bottom of the secondary of the i.f. output transformer. He would have gotten away with it, though, if we had not had a strong station on approximately twice the i.f. frequency."

Barney soon had the jack moved and the lead from it to the hot side of the volume control shielded. This cured the trouble completely.

"And now you may return my help—if you can," Mac told him. "See if you have any bright suggestions about this little a.c.-d.c. puzzler. When I first turn it on, it plays with good volume and has good sensitivity; but after it runs a few minutes, the volume slowly dies away, and the only station I can pick up is the local one. I checked the tubes the first thing, and they are all right. Plate and screen voltages stay right up close to the recommended values. The change in volume is far too gradual for it to be condenser trouble."

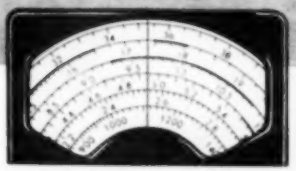
"Did you check the filament voltages?" Barney asked with a smug look.

"No, but the filament current seems to be about normal as near as I can see by looking at the brightness of the 50B5."

Barney switched off the bench lights and looked closely at the set. Then he switched the lights back on.

(*Continued on page* 132)

International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

FLAVIO Serrano, Brazil, airmails this data about prospective *new* high-powered transmitters for certain countries:

"*Radio Tupi*, Rio de Janeiro, Brazil, has purchased a 100 kw. short-wave transmitter from *Brown-Boveri*, a Swiss manufacturer. This transmitter will be ready in late 1952 and will be the world's most powerful *'commercial'* short-wave station; it is Model SK-51-A3. Both r.f. and modulator stages will use a push-pull *Brown-Boveri* type ATW-50-1 and have a spare tube which is placed in the circuit automatically when a failure occurs. The transmitter can operate from 6 to 22 mc. and also can be operated with 10 kw. output during an emergency. Tentative channel for *Radio Tupi* is 6.200.

"Representatives of the Swiss firm in Rio de Janeiro inform me that a similar transmitter is already installed in Yugoslavia and will begin operations shortly. Belgium has two such transmitters under installation for the Institute Nationale de Radiodiffusion which probably will be ready in mid-1952."

The two *new* 100 kw. short-wave transmitters of *Radio Sweden* at Horby should be in regular operation by this time carrying programs from Stockholm.

According to a *World Radio Handbook* Bulletin, Italy should now be using a short-wave transmitter located at Palermo on a channel of 6.260; a channel of 3.930 for a Rome transmitter, and 5.980 for a Milan station. From April 1, the National Program of *Radio Italiana* is to be radiated from a short-wave transmitter at Caltanissetta on 6.240.

YOUR ISW DEPARTMENT editor will welcome further news about forthcoming transmitters.—KRB.

• • •

Radio Club Notes

England—The International Short Wave Club, London, has just concluded its annual DX Contest for listeners to (1) the short-wave broadcast bands and (2) the amateur bands. Results of the competition will be announced in the May issue of the club's bulletin. Last year's awards went to all parts of the world, according to Arthur E. Bear, secretary of ISWC.

The International Short Wave League, London, is now an independent organization and no longer has any connection with *Short Wave News*, London. Headquarters of ISWL now is 123, Starla Road, Chatham, Kent, England; QSL Bureau is at 86, Barrenger Road, London, N. 10, England. Is publishing its own monthly bulletin called *"Monitor."* (*Short Wave News*, London)

USA—The Universal Radio DX Club recently observed its 18th anniversary. This is one of the few short-wave clubs that issues a short-wave log regularly. The winter edition (which goes to *members only*) was compiled by Weldon Wilson. Short-wave editor of URDXC is Donald C. Gross; ham band editor is Ralph W. Kastner; the certificate and award section of URDXC's bulletin *"Universalite"* is compiled by Don Martinez; president of the club is Charles Norton; QRA of URDXC is 21446 Birch Street, Hayward, Calif.

Harold Buchart, Box 76, Piketon, Ohio, president of the new club USWLW says that organization now has 40 members; wants more. Don Alexander, 1136 North 10th Street, Abilene, Texas, has been named short-wave editor and the club has started a monthly bulletin. A Canadian Chapter is being organized with John Impey as director. The club is making plans to award three trophies for outstanding efforts in the world of short-wave listening. Has its first DX Contest slated for the latter part of March.

• • •

(Note: Unless otherwise indicated, all time is expressed in American EST, add 5 hours for G.C.T. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.)

The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given. "A" means frequency is approximate.

This Month's Schedules

Andorra—*Radio Andorra*, 5.990, noted 1750 with identification by woman as "Aqui Radio Andorra," followed by semi-classical music. (Machwart, Mich.) Noted in England 1030 with announcements in French, Spanish. (Pearce)

Anglo-Egyptian Sudan—*Radio Omdurman* is using 9.737 in its "early morning" transmission in Arabic 2315-2345; stringed instrument is used as interval signal; still uses 17.94 in Arabic weekdays; Fridays has *English* on 17.94 at 1230-1300. (Ridgeway, South Africa) The *English* session is likely also carried over 9.737—KRB.

Angola—*Radio Clube do Cuanza-Sul*, CR6RP, Redondo, is on the air daily 0600-0745, 1230-1445 on 7.806, according to verification; power is 0.25 kw. (Radio Sweden) *Radio Clube do Benguela*, CR6RB, is again using its 9.163 channel with good signal in South Africa 1230-1630 closedown (Sundays to *only* 1430). (Ridgeway)

Radio Clube do Angola, 11.865A, Luanda, noted 1445; announces *two* channels. (Pearce, England) This one is still good signal in Conn. to 1530

(*Continued on page* 107)

This attractive Listening Post belongs to John C. Catch, South Shields, Durham, England. Equipment includes a "Commander" receiver, a tape recorder, and a frequency measuring device. John is a regular contributor to the ISW Department.



AUDIO *Simplified*

By
DAVID FIDELMAN



An installation where the record changer and preamp control circuit are mounted in a table and connected to other units in the system by a cable.

Part 7. A discussion of audio frequency networks and corrective circuits as used in high quality sound reproducing systems.

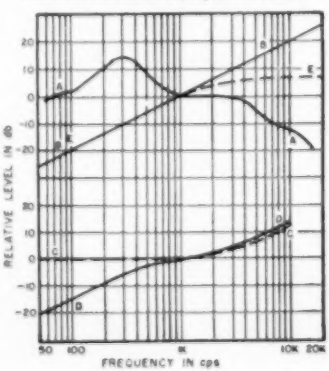
THE most widely accepted criterion of performance in the design and setup of sound reproducing systems is that the reproduction sound exactly the same as the original program material. However, this does not mean that the signal at all points in the system must correspond exactly with the original sound—it means only that the sound reaching the listener's ear from the loudspeaker should reproduce accurately the sound reaching the microphone from the original source. The proper application of this principle has caused considerable confusion in the field of sound reproduction, and its meaning should be clearly understood by anyone who is designing or setting up any sound reproducing system.

There is no necessity for making the signal at all points in the system reproduce exactly with the original sound, provided that any alterations which are made in the signal are corrected before they reach the ear from the loudspeaker. In fact, the limitations of practical recording, transmission, and reproduction systems make it almost imperative that certain changes be made in the signal in order to obtain the best quality of reproduction. These limitations are related primarily to questions of noise level and dynamic range. The actual dynamic range of orchestral music is approximately 75 db, which cannot be reproduced by modern equipment—especially when phonograph records are included in the system. The major factor which prevents the reproducing system from attaining the required dynamic range is the inherent noise level of the system, which is considered to be good if it is more than —60 db below full output, while —50 db is considered acceptable. Therefore, as might be expected, most of the changes which are made in the signal are intended to reduce the noise level.

This article will discuss the various methods which can be used to reduce the noise level and increase the dynamic range of the reproduced sound. These methods include the use of tone controls and equalizers, volume compressors and expanders, and various types of noise suppressors. The fundamental principles of operation will be described, with a discussion of the important factors which must be kept in mind for their proper use and to prevent their misuse, and a number of basic practical circuits which can be included in the reproducing system.

The use of tone controls for reduction of noise depends upon the fact that the noise is not dependent upon frequency in quite the same way that the ear perceives speech and music as a function of frequency. Sound is heard by the ear in a logarithmic manner—with respect to frequency as well as volume. The logarithmic frequency response of the ear may be illustrated by the use of the term *octave* to denote a frequency range of 2:1 regardless of the absolute frequency, and musical scales are always written in terms of octaves from a particular reference frequency. The noise, on the other hand, is generally a direct function of frequency. Therefore, since an octave at higher frequencies covers a greater absolute frequency range than an octave at lower frequencies, the effects of noise are relatively more important at high frequencies than at low frequencies.

Fig. 1. Use of pre-emphasis to reduce reproduction noise. Curve A is most probable distribution of frequency components in music at high levels. B is frequency spectrum of random noise. C is FM pre-emphasis characteristic. D is NAB recording characteristic and E is reproduced noise when the proper de-emphasis characteristic is used in the playback channel.



This property of noise is realized instinctively by those people who listen to their phonograph records with the tone controls set to decrease the high-frequency response and thereby reduce the record scratch. This method of reducing the record noise is not a desirable one, since the higher frequencies are lost from the reproduced sound, but to these listeners the effects of the noise are more objectionable than the loss of high frequencies.

However, even without reducing the high-frequency range of the system it is possible, because of the different frequency characteristics of the noise and of the reproduced sound, to reduce the reproduced noise level by the use of *pre-emphasis*. The relative frequency distribution of sound energy in orchestral music is shown in curve *A* of Fig. 1. This curve shows that there is considerably less sound energy

at the higher frequencies than at the lower. Curve *B* shows the sound spectrum of a random noise plotted to the same frequency scale (and at an arbitrary 0 db level), and shows its relatively greater effect at the higher frequencies. It must be noted that such noise is generally introduced into the signal *after* the sound has been transmitted or recorded. Therefore, the most basic and simplest method of reducing the reproduced noise level is to increase the amplitude of the high frequencies in the channel before recording (that is, before the introduction of the noise), and then to decrease the high-frequency level by the corresponding amount in playback (which is after the introduction of the noise). The net effect is to decrease the noise level by the amount the high frequencies have been pre-emphasized.

This system of pre-emphasis is in use in FM broadcasting, and accounts for a considerable amount of the noise superiority of FM over AM. If pre-emphasis were used in AM broadcasting, the received signal would contain a much lower noise component than it does with the present method. The technique of pre-emphasis is also used in disc and tape recording to reduce the effects of playback noise. The frequency response curve which is used to achieve this effect in FM broadcasting is shown in curve *C* of Fig. 1, and the standard NAB recording curve is shown as *D*. (In the curve used for recording, the drop at the low-frequency end is necessary because of the practical limitations on the amplitude of motion of the recording stylus.) The effective decrease in noise level by the use of this technique in recording is shown by curve *E* in Fig. 1.

The basic methods of obtaining the frequency-response curves required for pre-emphasis and de-emphasis make use of *RC*, *RL*, and *RLC* circuits. The circuits which are of most interest to the audio experimenter are those for de-emphasis in playback, and these usually make use of simple *RC* networks to obtain the required curves. The basic *RC* tone control and equalizer circuits are shown in Fig. 2. They depend for their operation upon the fact that a resistance is constant independent of frequency, while the reactance of a condenser decreases as the frequency increases. Thus, in the simple series attenuator shown in Fig. 2, when the two impedances are pure resistances the output level does not change with frequency, remaining a constant percentage of the input voltage. However, when either of the two impedances is a capacity the output level will change with frequency—increasing at the higher frequencies to give treble boost when the series impedance is a capacity, and increasing at the lower frequencies to give bass boost when the shunt impedance is a capacity.

The general frequency correction circuit, which can be used as a basis for the practical design of all types of equalizers with a constant voltage input, is shown in Fig. 3. Some of the most useful tone control circuits based upon this general circuit are also shown in Fig. 3, together with typical frequency response curves which are obtained. It can readily be seen how the variation of capacitive reactance with frequency (that is, becoming very large at low frequencies, and very small at high frequencies), results in the indicated response. Circuits very similar to those shown are used in the majority of sound systems.

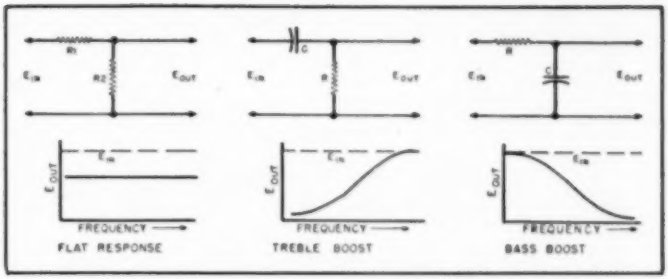
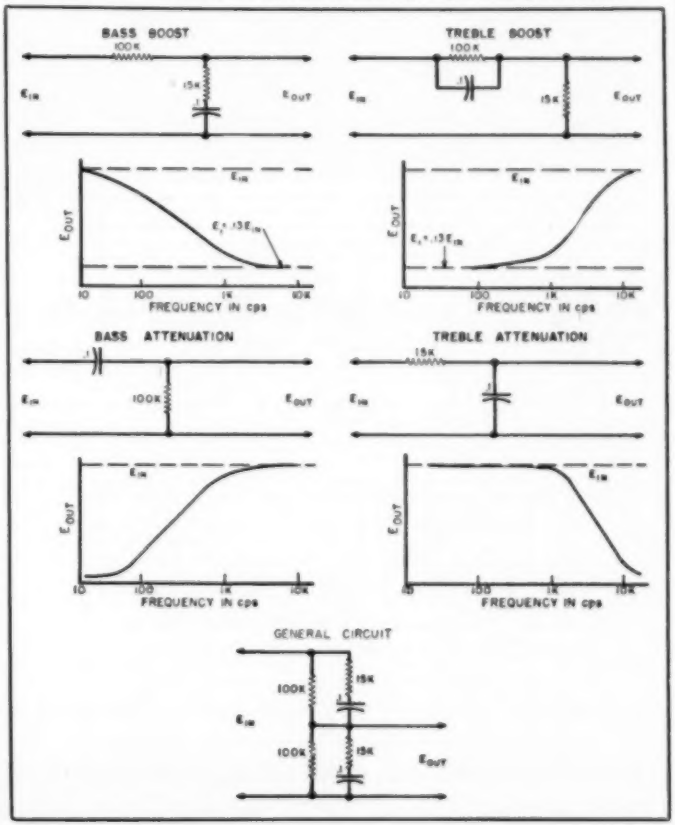


Fig. 2. Basic RC tone control and equalizer circuits for three different conditions.

In many cases the pre-emphasis curves in recording and the de-emphasis curves in playback may not always be properly matched to one another, and in the resulting reproduced sound either the high frequencies or the low frequencies may be overemphazised or underemphasized. An adjustable equalizer or *tone-control* network should be included in the reproduction channel to provide for frequency-response correction when the reproduced sound does not have the

Fig. 3. RC tone control and equalizer circuits including suitable parts values.



proper balance between high frequencies and low frequencies. A flexible tone-control circuit should have a high-frequency control which could be set for either boost or attenuation of the highs, and a low-frequency control which is capable of either boost or attenuation of the lows.

The circuit of a simple network which serves as a variable tone control is shown in Fig. 4. This network has independent bass and treble controls which are capable of giving the range of frequency response curves shown in C of Fig. 4. The treble control can be adjusted over the complete range of settings from 15 db boost to 15 db attenuation at 20,000 cps, while the bass control may be set to give from 13 db accentuation to 13 db attenuation at 50 cps. Since the controls are continuously adjustable, any intermediate setting between these two extremes may be obtained—including a flat-frequency-response position. The principle of operation of this circuit may be more clearly understood from the simplified circuits shown in Fig. 4B, which show the equivalent circuits in the *maximum bass and treble* positions, and by comparing them with the basic tone control circuit of Fig. 3.

The circuits which have been described are high-impedance networks and should have a constant-voltage input, therefore the method of their connection into the playback circuit is somewhat critical. For best results, the tone control circuit should be isolated by a triode amplifier stage (such as the 6J5, ½-6SN7, ½-6SL7, ½-12AT7, etc.), and should feed directly into the high-impedance grid of the following stage. The method of isolating the tone control network by a triode amplifier stage is shown in the circuit of Fig. 4A.

It should be kept in mind that all equalizer networks operate on the principle of attenuating certain frequencies to give their frequency response—since they obviously cannot deliver a greater voltage than is applied to their input. Therefore an equalizer which gives a 15 db bass boost actually attenuates all frequencies but the bass by 15 db, and leaves the bass level unchanged. The usual tone control network will thus have an insertion loss of about 15 to 20 db at the middle frequencies, and must therefore be inserted in the playback amplifier circuit at a point where this insertion loss can be handled properly—where the level is sufficiently high that noise will not be a problem after the 20 db attenuation, and where the level is still not so high the tube overloads.

Compression and Expansion

Even with the use of pre-emphasis techniques, an over-all noise level of better than —60 db below full output is fairly difficult to attain. When reproduction from records or AM broadcasting is included in the channel the noise level will generally be considerably higher—as high as —40 db below peak signal or even more for bad records. Since the actual dynamic range to be reproduced may be as high as 75 db, the noise level (even assuming the —60 db figure) prevents the reproduction of this entire dynamic range of signals. Thus, if the output is set for maximum at the highest signal level, the low-level signals will be lost in the noise. Furthermore, the maximum output of the system may be too loud for comfortable listening.

To improve this condition, the sound signal is usually monitored during recording or transmission, and the gain in the channel is adjusted to reduce the dynamic range. This function may be performed either manually by an operator who watches a signal-level meter and adjusts a gain control to keep the signal peaks within specified limits, or automatically by electronic gain-adjusting circuits. The automatic electronic units need just be set up properly for the particular signal being transmitted or recorded, and then observed periodically to insure proper operation.

The functioning of the electronic units for automatic gain adjustment is based upon two different principles:

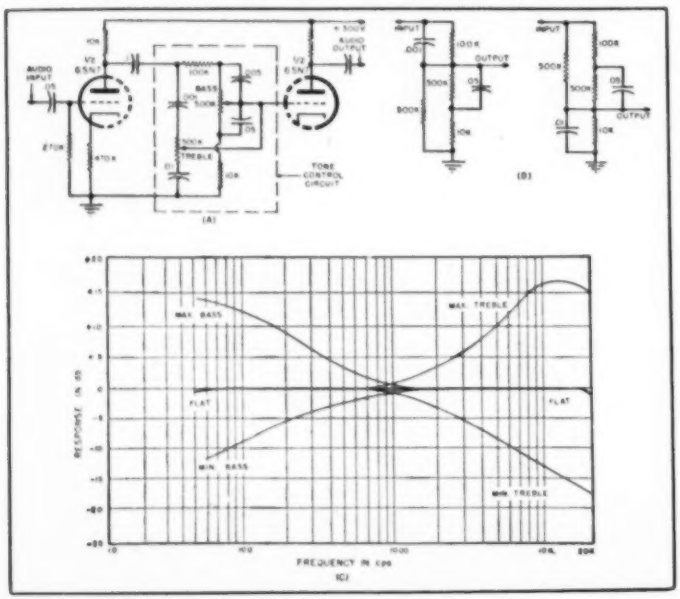
(*a*) *Volume compression* in which the channel gain is reduced in proportion as the signal level increases so that the resulting dynamic range of the signal is the same as that of the reproducing system. The operation of this system is based upon approximately the same principle as that of manual gain adjustment, in which the operator decreases the gain for loud signals to keep them below some specified maximum, and increases the gain for low levels to keep them above some specified minimum.

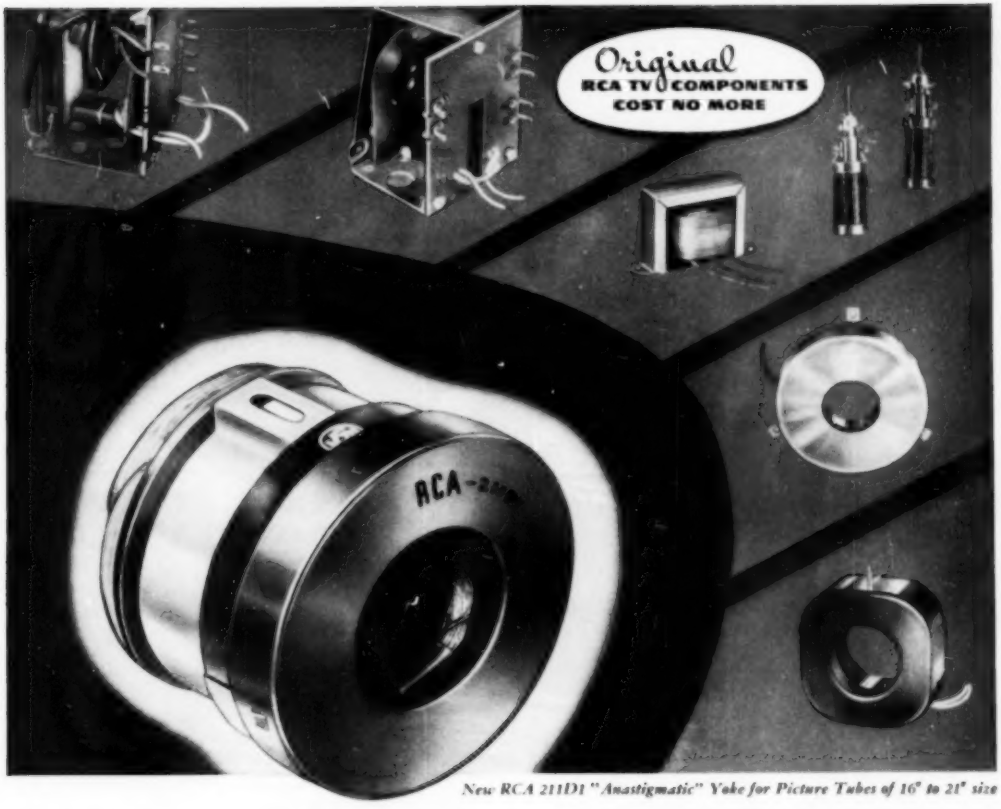
(*b*) *Peak limiting* in which the channel gain is adjusted to keep all low-level signals above the noise level, and gain control is applied only to the loud peaks. The high levels are then transmitted at their normal level as long as they are not greater than some fixed maximum which can be handled by the system without excessive distortion. Whenever the signal has a greater amplitude, the gain is reduced enough to bring this amplitude down to this same maximum amplitude.

Thus, the volume compression method decreases the dynamic range gradually for signals of all levels, whereas the peak limiting method does not affect signals below the channel maximum and limits high-level peaks to this maximum. In playback, a *volume expander* circuit which performs the inverse function may be used to restore the dynamic range of the original signal. The curves in Fig. 5 illustrate the basic functions of these units by showing typical curves of output signal levels for various input levels. If a volume expander circuit is used with a signal which has been compressed, the original dynamic range is restored accurately; if a peak limiter has been used in transmitting the signal, the reproduced dynamic range is increased but the relative signal levels are altered.

(*Continued on page* 116)

Fig. 4. (A) Variable tone control circuit, showing method of matching into amplifier circuit. (B) Simplified schematics showing operation of circuit at extreme control settings—maximum bass and maximum treble (left) and minimum bass and minimum treble (right). (C) Frequency response curves obtained with circuit shown in (A).





New RCA 211D1 "Anastigmatic" Yoke for Picture Tubes of 16" to 21" size

For best results use the yoke that's *tailored to the tube*

Check these features . . .

- ✓ **Distributed windings of modified "cosine" design for sharp corner focus**
- ✓ **Negligible pattern distortion**
- ✓ **Freedom from insulation breakdown**
- ✓ **Terminals securely mounted**
- ✓ **Sturdy molded housing**

Why take chances with "compromise" yokes when RCA "originals" cost no more?

Remember—RCA deflecting yokes set the engineering standards of the field. That's because RCA deflecting yokes and RCA picture tubes are designed to work as a team. Mechanically and electrically, RCA yokes "fit like a glove"... work best with the picture tubes they're specifically designed for.

Always the leader—RCA deflecting yokes were the first to use Ferrite cores . . . first to use distributed windings providing negligible barrel and pincushion distortion. And . . . RCA yokes were the first to be constructed with a molded housing of solid plastic that affords increased insulation between windings and core, insures high resistance to humidity, and holds terminal lugs firmly.

RCA yokes are best fitted to restore original performance in the many makes of TV receivers you service. When a replacement is called for, play safe . . . use the yoke that "fits the tube." *That's RCA!*

See your local RCA Parts Distributor for "Original" RCA TV Components.

RADIO CORPORATION of AMERICA

ELECTRONIC COMPONENTS **HARRISON, N. J.**

Features OF THE NEW 1952 Heathkits



PROOF OF THE NEW O-7 OSCILLOSCOPE'S OUTSTANDING PERFORMANCE

Below are actual, unretouched photographs showing the outstanding frequency response characteristics of the NEW 1952 HEATHKIT OSCILLOSCOPE MODEL O-7. To the left is a 10 KC square wave — to the right a 4 MC sine wave as they actually appear on the screen. Two highly severe tests to make on any scope (only the best of scopes will show traces like these) — and the O-7 really comes through.



COMPANION VACUUM TUBE VOLTMETERS

Here are the two NEW 1952 VACUUM TUBE VOLTMETER COMPANION PIECES. Matched instruments of new design to open up the whole field of DC, AC, and resistance measurements for you. The new greatly reduced size combines style, beauty, and compactness — The V-3 and AV-3 have the new panel and cabinet construction as shown on the right. A tremendous part as shown on Small in size but virtual giants in the range of measurements they make.



NEW STYLE AND BEAUTY

Style that's modern, yet functional — that's the trend of today — and Heathkits are right up to the minute. Note the cut showing the new V-3 and AV-3 cabinet and panel construction. The front panel and rear cover slide right over the recessed flange of the case thereby eliminating sharp edges and pointed corners. The voltmeter kits aren't "shelf" or "mounted" instruments — they're moved about on the bench a lot and thus the new compact size and specially designed cabinets — Another 1952 Heathkit feature.

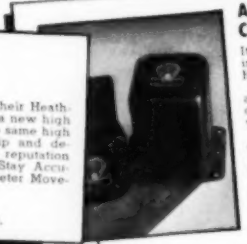


A STATEMENT FROM SIMPSON ELECTRIC CO.



In choosing Simpson Meters for their Heathkit VTVM, the Heath Co. has set a new high standard of kit meter quality. The same high quality of material, workmanship and design that has given Simpson the reputation for building "Instruments That Stay Accurate" is found in the Heathkit Meter Movement.

SIGNED
SIMPSON ELECTRIC CO.



A STATEMENT FROM CHICAGO TRANSFORMER

It is indeed gratifying to note the outstanding sales records you are building with you Heathkits.

This sales success is readily understandable, since we are cognizant of the high quality standards you have established for your component suppliers.

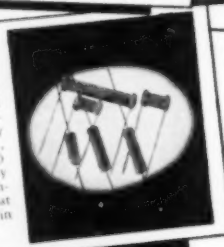
We at Chicago Transformer are proud that our product has contributed to the recognized quality and increasing popularity of Heathkits.

CHICAGO TRANSFORMER DIVISION
Essex Wire Corporation

L. S. RACINE
Vice-President and Sales Manager

HEATHKIT PRECISION RESISTORS

Where exact resistance values are required for instrument accuracy, the Heath Co. has spared no effort in supplying the finest resistors available. Precision resistors as manufactured by Continental Carbon Inc., and Wilcot Corp., meet the rigorous JAN-(Joint Army-Navy) specifications and are small in size, extremely non-inductive, highly stable, have a low temperature coefficient, and can be held to great accuracy. You'll find quality components in Heathkits.



COLLEGES USE HEATHKITS

Colleges and Universities throughout the country are using Heathkits in their electrical engineering, radio, and physics laboratories — Heathkits are the answer to good test equipment at low cost, plus being rugged, dependable and accurate. Trade schools are having their students build Heathkits to obtain a first hand working knowledge of test equipment and to get the practical experience gained by construction. Heathkits fill school needs.



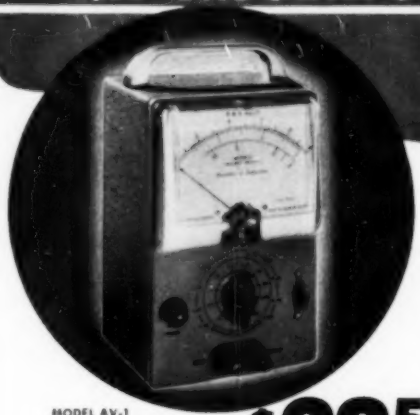
YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER—USE ORDER BLANK ON LAST PAGE

ROCKE INTERNATIONAL CORP
15 E. 40th ST.
NEW YORK CITY (16)

The HEATH COMPANY

. . . BENTON HARBOR 15, MICHIGAN

New LABORATORY LINE HEATHKITS



NEW *Heathkit* A.C. VACUUM TUBE VOLTMETER KIT

MODEL AV-1
Shipping weight 5 lbs.

$29.50

Now — as a Heathkit — at a price anyone can afford, an AC VTVM. A new kit to make possible those sensitive AC measurements required by audio enthusiasts, laboratories, and experimentors. Here is the kit that the audio men have been looking for. Its tremendous range of coverage makes possible measurements of audio amplifier frequency response — gain or loss of audio stages — characteristics of audio filters and attenuators — hum investigation — and literally a multitude of others. Ten ranges consisting of full scale .01, .03, .1, .3, 1, 3, 10, 30, 100, 300 volts RMS assure easy and more accurate readings. Ten ranges on DB provide for measurements from −52 to +52 DB. Frequency response within 1 DB from 20 cycles to 50 KC.

The ingenious circuitry incorporates precision multiplier resistors for accuracy, two amplifier stages using miniature tubes, a unique bridge rectifier meter circuit, quality Simpson meter with 200 microampere movement, and a clean layout of parts for easy wiring. A high degree of inverse feedback provides for stability and linearity.

Simple operation is accomplished by the use of only one control, a range switch which changes the voltage ranges in multiples of 1 and 3, and DB ranges in steps of 10.

The instrument is extremely compact, cabinet size — 4⅛" deep x 4-11/16" wide x 7⅛" high, and the newly designed cabinet makes this the companion piece to the VTVM. For audio work, this kit is a natural.

NEW *Heathkit* AUDIO FREQUENCY METER KIT

MODEL AF-1
Shipping weight 12 lbs.



$34.50

A NEW Heathkit Audio Frequency Meter — the ideal instrument for determining frequencies from 20 cycles to 100 KC. Set the selector switch to the proper range — feed the signal into the input terminals — and read the frequency from the meter — completely simple to operate, and yet dependable results.

Quality Simpson 200 microampere meter has two plainly marked scales (0-300 0-500). These scales, read in conjunction with the seven position selector switch, give full scale readings of 100, 300, 1000, 3000, 10,000, 30,000, and 100,000 cycles. Convenient ranges for fast and easy readings.

For greatest accuracy, the 1-3-10 ratio of ranges is maintained and each range has individual calibrating control.

Input impedance is high (1 megohm) for negligible circuit loading. A signal voltage anywhere between 2 and 300V can be fed directly into the instrument and a change in signal voltage between these limits will not affect the meter reading. In addition, input wave shape is not critical (the unit will read the frequency of either sine wave or square wave input).

The tube complement consists of a 6SJ7 amplifier and clipper, 6V6 amplifier and clipper, 6H6 meter pulse rectifier, 6X5 power supply rectifier, and OA3/VR150 voltage regulator.

Construction is simple, and quality components are used throughout.

NEW *Heathkit* INTERMODULATION ANALYZER KIT



MODEL IM-1
Shipping wt. 18 lbs.

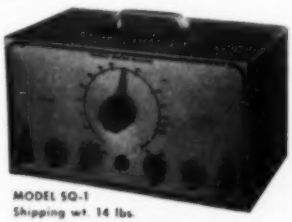
$39.50

Intermodulation testing of audio equipment is rapidly being accepted by more and more engineers and audio experts as the best way to determine the characteristics of audio amplifiers, recording systems, networks, etc. — shows up those undesirable characteristics which contribute to listening fatigue when all other methods fail.

The Heathkit Intermodulation Analyzer supplies a choice of two high frequencies (3000 cycles and a higher frequency) and one low frequency (60 cycles). Both 1:1 or 4:1 ratios of low to high frequencies can be set up for IM testing, and the ratios are easily set by means of a panel control and the instrument's own VTVM. An output level control supplies the mixed signal at the desired level with an output impedance of two thousand ohms. The Analyzer section has input level control and proper filter circuits feeding the instrument's VTVM to read intermodulation directly on full scale ranges of 30%, 10% and 3%. Built-in power supply furnishes all necessary voltages for operating the instrument.

You won't want to be without this new and efficient means of testing.

NEW *Heathkit* SQUARE WAVE GENERATOR KIT



MODEL SQ-1
Shipping wt. 14 lbs.

$29.50

The new Heathkit Square Wave Generator Kit with its 100 KC square wave opens an entirely new field of audio testing. Square wave testing over this wide range will quickly show high and low frequency response characteristics of circuits — permit easy adjustment of high frequency compensating networks used in vidio amplifiers — identify ringing in circuits — demonstrate transformer characteristics, etc.

The circuitry consists of a multivibrator stage, a clipping and squaring stage, and a cathode follower output stage. The power supply is transformer operated and utilizes a full wave rectifier tube with 2 sections of LC filtering.

As a multivibrator cannot be accurately calibrated, a provision is provided to allow the instrument to be accurately synchronized with an accurate external source when extreme accuracy is required.

The low impedance output is continuously variable between 0 and 25 volts and operation is simple. You'll really appreciate the wide range of this instrument, 10 cycles to 100 kilocycles — continuously variable. Kit is complete with all parts and instruction manual, and is easy to build.

YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER—USE ORDER BLANK ON LAST PAGE

ROCKE INTERNATIONAL CORP
NEW YORK CITY (16)

The HEATH COMPANY

. . . BENTON HARBOR 15, MICHIGAN

THE *New* 1952

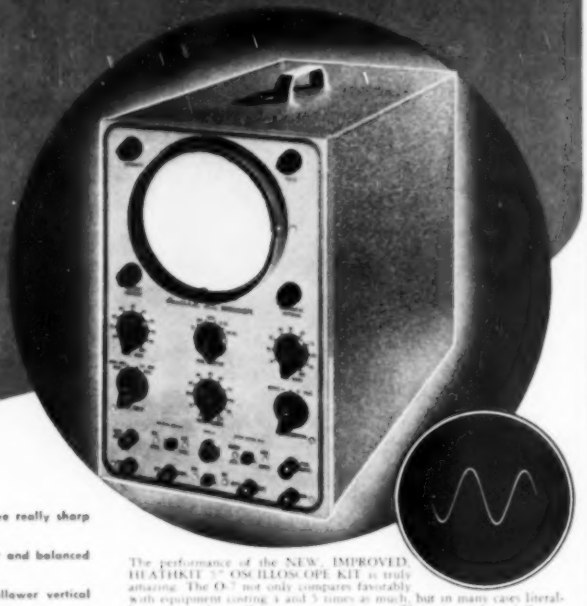
Heathkit

OSCILLOSCOPE KIT

MODEL O-7

SHIPPING WEIGHT 24 LBS.

$43.50



Features

- New "spot shape" control for spot adjustment — to give really sharp focusing.
- A total of ten tubes including CR tube and five miniatures.
- Cascaded vertical amplifiers followed by phase splitter and balanced push-pull deflection amplifiers.
- Greatly reduced retrace time.
- Step attenuated — frequency compensated — cathode follower vertical input.
- Low impedance vertical gain control for minimum distortion.
- New mounting of phase splitter and deflection amplifier tubes near CR tube base.
- Greatly simplified wiring layout.
- Increased frequency response — useful to 5 Mc.
- Tremendous sensitivity .03V RMS per inch Vertical — .6V RMS per inch Horizontal.
- Dual control in vernier sweep frequency circuit — smoother acting.
- Positive or negative peak internal synchronization.

The performance of the NEW, IMPROVED HEATHKIT 5" OSCILLOSCOPE KIT is truly amazing. The O-7 not only compares favorably with equipment costing 3 and 5 times as much, but in many cases literally surpasses the really expensive equipment. The new, and carefully engineered circuit incorporates the best in electronic design — and a multitude of excellent features all contribute to the outstanding performance of the new scope.

The VERTICAL CHANNEL has a step attenuated, frequency compensated vertical input which feeds a cathode follower stage — this accomplishes improved frequency response, presents a high impedance input, and places the vertical gain control in a low impedance circuit for minimum distortion. Following the cathode follower stage is a two triode — cascaded amplifiers to contribute to the scope's extremely high sensitivity. Next comes a phase splitter stage which properly drives the push-pull, hi-gain, deflection amplifiers (whose plates are directly coupled to the vertical deflection plates). This fine tube lineup and circuitry give a sensitivity of .03V per inch RMS vertical and useful frequency response to 5 Mc.

The HORIZONTAL CHANNEL consists of a triode phase splitter with a dual potentiometer (horizontal gain control) in its plate and cathode circuits for smooth, proper driving of the push-pull horizontal deflection amplifiers. As in the vertical channel, horizontal deflection amplifier plates are direct coupled to the CR tube horizontal deflection plates (for improved frequency response).

The WIDE RANGE SWEEP GENERATOR circuit incorporates a two triode multivibrator stage for producing a good saw-tooth sweep frequency (with faster retrace time). Has both coarse and vernier sweep frequency controls.

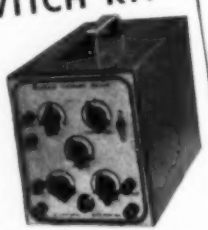
And the scope has internal synchronization which operates on either positive or negative peaks of the input signal — both high and low voltage inputs — Z axis modulation (intensity modulation) — new spot shape (astigmation) control for spot adjustment — provision for external synchronization — vertical centering and horizontal centering controls, wide range focus control — and an intensity control for giving plenty of trace brilliance.

The Model O-7 EVEN HAS GREAT NEW MECHANICAL FEATURES — A special extra-wide CR tube mounting bracket is provided so that the vertical cascade amplifier, vertical phase splitter, vertical deflection amplifier, and horizontal deflection amplifier can mount near the base of the CR tube. This permits close connection between the above stages and to the deflection plates; distributed wiring capacity is greatly reduced, thereby affording increased high frequency response.

The power transformer is specially designed so as to keep its electrostatic and electromagnetic fields to a minimum — also has an internal shield with external ground lead.

You'll like the complete instructions showing all details for easily building the kit — includes pictorials, step-by-step construction procedure, numerous sketches, schematic, circuit description. All necessary components included — transformer, cabinet, all tubes (including CR tube), completely punched and formed chassis — nothing else to buy.

NEW INEXPENSIVE *Heathkit* ELECTRONIC SWITCH KIT



The companion piece to a scope — Feed two different signals into the switch, connect its output to a scope, and you can observe both signals (such as an individual trace). Gain of each input is easily set — gain A and gain B controls; the switching frequency is simple to adjust (course and fine frequency controls) and the traces can be superimposed for comparison or separated for individual study (position control).

Use the switch to see distortion, phase shift, clipping due to improper bias both the input and output traces of an amplifier — as a square wave generator over limited range.

The kit is complete, all tubes, switches, cabinet, power transformer and all other parts, plus a clear detailed construction manual.

Model S-2
Shipping Wt. 11 lbs.

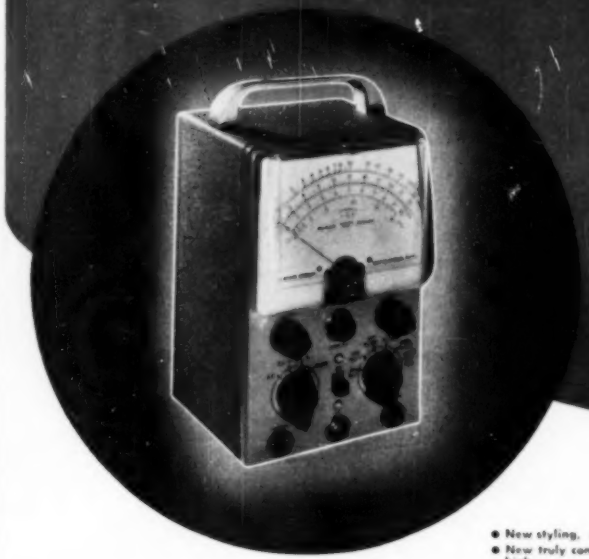
Only

$19.50

YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER—USE ORDER BLANK ON LAST PAGE

HEATH COMPANY

. . . BENTON HARBOR 15, MICHIGAN



THE *New* 1952

Heathkit VTVM KIT

MODEL V-5
SHIPPING WT. 5 LBS.

$24.50

Features

- **New styling, — formed case for beauty.**
- **New truly compact size. Cabinet 4⅛" deep by 4-11/16" wide by 7⅛" high.**
- **Quality 200 microamp meter.**
- **New ohms battery holding clamp and spring clip — assurance of good electrical contact.**
- **Highest quality precision resistors in multiplier circuit.**
- **Calibrates on both AC and DC for maximum accuracy.**
- **Terrific coverage — reads from ½V to 1000V AC, ½V to 1000V DC, and .1 to over 1 billion ohms resistance.**
- **Large, clearly marked meter scales indicate ohms, AC Volts, DC Volts, and DB — has zero set mark for FM alignment.**
- **New styling presents attractive and professional appearance.**

A real beauty — you'll have only highest praise for this NEW MODEL VACUUM TUBE VOLTMETER. Truly a beautiful little instrument — and it's more compact than any of our previous models. Note the new rounded edges on the front panel and rear cover. The size is greatly reduced to occupy a minimum of space on your workbench — yet the meter remains the same large size with plainly marked scales.

A set of specially designed control mounting brackets permit calibration to be performed with greatest ease — also makes for ease in wiring. New battery mounting clamp holds ohms battery tightly into place, and base spring clip insures a good connection to the ohms string of resistors.

The circuitry employs two vacuum tubes — A duo diode operating when AC voltage measurements are taken, and a twin triode in the circuit at all times. The cathode balancing circuit of the twin triode assures sensitive measurements, and yet offers complete protection to the meter movement. Makes the meter burn-out proof in a properly constructed instrument.

Quality components are used throughout.—1% precision resistors in the multiplier circuit—conservatively rated power transformer—Simpson meter movement — excellent positive detent, smooth acting switches — sturdy cabinet, etc.

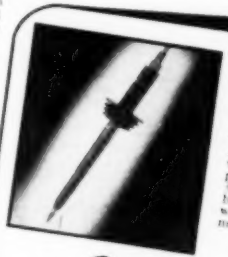
And you can make a tremendous range of measurements — ½V to 1000V AC, ½V to 1000V DC, .1 to over 1 billion ohms, and DB. Has mid-scale zero level marking for quick FM alignment. DB scale in red for easy identification — all other scales a sharp, crisp black for for easy reading.

A four position selector switch allows operator to rapidly set the instrument for type or reading desired—positions include ACV, DC+V, DC−V, and Ohms. DC− position allows negative voltages to be rapidly taken. Zero adjust and ohms adjust controls are conveniently located on front panel.

Enjoy the numerous advantages of using a VTVM. Its high input impedance doesn't "load" circuits under test — therefore, assures more accurate and dependable readings in high impedance circuits such as resistance coupled amplifiers, AVC circuits, etc. Note the 30,000 VDC probe kit and the RF probe kit — available at low extra cost and specially designed for use with this instrument. With these two probes, you can make DC voltage measurements up to 30,000V, or make RF measurements — added usefulness to an already highly useful instrument.

The instruction manual is absolutely complete — contains a host of figures, pictorials, schematic, detailed step-by-step instructions, and circuit description. These clear, detailed instructions make assembly a cinch.

And every part is included — meter, all controls, pilot light, switches, test leads, cabinet, instruction manual, etc.



Heathkit 30,000V DC
PROBE KIT

A new 30,000 V DC Probe Kit to handle high voltages with safety. For TV service work and all other high voltage applications. Sleek looking — Two color molded plastic — Red body and guard — jet black handle — comes with connector, cable, and PL55 type plug. Plugs into Heathkit VTVM so that 500V scale is conveniently multiplied by 100. Can be used with any standard 11 megohm VTVM.

$5.50

No. 336 High Voltage Probe Kit • Shipping Wt. 2 lbs.

Heathkit
RF PROBE KIT

This RF Probe Kit comes complete with probe housing, crystal diode detector, connector, lead and plug and all other parts plus clear assembly instructions. Extends range of Heathkit VTVM to 250 Mc. ± 10%. Works on any 11 megohm input VTVM. Specify No. 309 RF Probe Kit.

$5.50 • Ship. Wt. 1 lb.



YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER—USE ORDER BLANK ON LAST PAGE

ROCKS INTERNATIONAL CORP
122 E. 42nd ST.
NEW YORK CITY 16

The HEATH COMPANY

. . . BENTON HARBOR 15, MICHIGAN

Heathkit

SIGNAL GENERATOR KIT



Model SG-6
Shipping Wt. 7 lbs.

$19.50

The new Heathkit Signal Generator Kit has dozens of improvements. Covers the extended range of 160 Kc to 50 megacycles on fundamentals and up to 150 megacycles on useful calibrated harmonics; makes this Heathkit ideal as a marker oscillator for TV. Output level can be conveniently set by means of both step attenuator and continuously variable output controls. Instrument has new miniature HF tubes to easily handle the high frequencies covered.

Uses 6C4 master oscillator and 6C4 sine wave audio oscillator. The kit is transformer operated and a husky selenium rectifier is used in the power supply. All coils are precision wound and checked for calibration making only one adjustment necessary for all bands.

New sine wave audio oscillator provides internal modulation and is also available for external audio testing. Switch provided allows the oscillator to be modulated by an external audio oscillator for fidelity testing of receivers. Comes complete, all tubes, cabinet, test leads, every part. The instruction manual has step-by-step instructions and pictorials. It's easy and fun to build a Heathkit Model SG-6 Signal Generator.

Heathkit

CONDENSER CHECKER KIT

Only

$19.50

Model C-2
Shipping Wt. 6 lbs.



Checks all types of condensers — paper — mica — ceramic — electrolytic. All condenser scales are direct reading and require no charts or multipliers. Covers range of .00001 MFD to 1000 MFD. A Condenser Checker that anyone can read. A leakage test and polarizing voltage for 20 to 500 V provided. Measures power factor of electrolytics between 0% and 50% and reads resistance from 100 ohms to 5 megohms. The magic eye indicator makes testing easy.

The kit is 110V 60 cycle transformer operated and comes complete with rectifier tube, magic eye tube, cabinet, calibrated panel and all other parts. Has clear detailed instructions for assembly and use.

NEW *Heathkit*

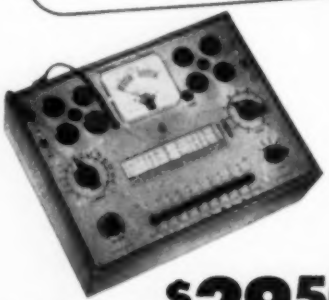
SIGNAL TRACER AND UNIVERSAL TEST SPEAKER KIT

$19.50

Model T-2
Shipping Wt. 7 lbs.



The popular Heathkit Signal Tracer has now been combined with a universal test speaker at no increase in price. The same high quality tracer follows signal from antenna to speaker — locates intermittents — finds defective parts quicker — saves valuable service time — gives greater income per service hour. Works equally well on broadcast, FM, or TV receivers. The test speaker has an assortment of switching ranges to match either push-pull or single output impedances. Also tests microphones, pickups and PA systems. Comes complete: cabinet, 110V 60 cycle power transformer, tubes, test probe, all necessary parts, and detailed instructions for assembly and use.



Model TC-1
Shipping Wt. 12 lbs.

$29.50

Heathkit

TUBE CHECKER KIT

The Tube Checker is a MUST for radio repair men. Often customers want to SEE tubes checked, and a checker like this builds customer confidence. In your repairing, you will have a multitude of tubes to check — quickly. The Heathkit tube checker will serve all these functions — it's good looking (with a polished birch cabinet and an attractive two color panel) — checks 4, 5, 6, 7 prong Octals, Loctals, 7 prong miniatures, 9 prong miniatures, pilot lights, and the Hytron 5 prong types. AND IT'S FAST TO OPERATE — the gear driven, free-running roll chart lists hundreds of tubes, and the smooth acting, simplified switching arrangement gives really rapid set-ups.

The testing arrangement is designed so that you will be able to test new tubes of the future — without even waiting for factory data — protection against obsolescence.

You can give tubes a thorough testing — checks for opens, shorts, each element individually, emission, and for filament continuity. A large BAD-?-GOOD meter scale is in three colors for easy reading and also has a "line-set" mark.

You'll find this tube checker kit a good investment — and it's only $29.50.

YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER—USE ORDER BLANK ON LAST PAGE

ROCKE INTERNATIONAL CORP
NEW YORK CITY

The HEATH COMPANY

. . . BENTON HARBOR 15, MICHIGAN

NEW 1952 *Heathkit*

BATTERY ELIMINATOR KIT



- **Can be used as battery charger.**
- **Continuously variable output 0 - 8 Volts — not switch type.**
- **Heavy duty Mallory 17 disk type magnesium copper sulfide rectifier.**
- **Automatic overload relay for maximum protection. Self-resetting type.**
- **Ideal for battery, aircraft and marine radios.**
- **Dual Volt and Ammeters read both voltage and amperage continually — no switching.**

The new Heathkit Model BE-2 incorporates the best. Continuously variable output control is of the variable transformer type with smooth wiper type contacts.

There are no switches or steps and voltage between 0 and 8 Volts is available at 10 Amperes continuous and 15 Amperes intermittent. Maximum safety from overloads and shorts provided by automatic overload relay which resets itself when overload is removed.

The new rectifier is a 17 plate Mallory magnesium copper sulfide type. This is the most rugged type available for long trouble-free use.

Output is continuously metered by both a 0 - 10 Volt Voltmeter and a 0 - 15 Amp Ammeter. Shorted vibrators indicated instantly by ammeter.

Equip now for all types of service — aircraft — marine — auto and battery radios — this inexpensive instrument vastly increases service possibilities — better be ready when the customer walks in.

$24.50

Model BE-3
Shipping Wt. 17 lbs.

NEW *Heathkit*
SINE AND SQUARE WAVE

AUDIO GENERATOR KIT



Designed with versatility, usefulness and dependability in mind, the AG-7 gives you the two most needed wave shapes right at your fingertips — the sine wave and the square wave.

The range switch and plainly calibrated frequency scale give rapid and easy frequency selection, and the output control permits setting the output to any desired level.

A high-low impedance switch sets the instrument for either high of low impedance output — on high to connect a high impedance load, and on low to work into a low impedance transformer with negligible DC resistance.

Coverage is from 20 to 20,000 cycles, and distortion is at a minimum — you can really trust the output wave shape.

Six tubes, quality 4 gang tuning condenser, power transformer, metal cased filter condenser, 1% precision resistors in the frequency determining circuit, and all other parts come with the kit —plus, a complete construction manual — A tremendous kit, and the price is truly low.

Model AG-7
Shipping Wt. 13 lbs.

$34.50

THE NEW *Heathkit*

HANDITESTER KIT



A precision portable volt-ohm milliammeter. Uses only high quality parts — All precision 1% resistors, three deck switch for trouble-free mounting of parts, specially designed battery mounting bracket, smooth acting ohm adjust control, beautiful molded bakelite case, 400 micro-amp meter movement, etc.

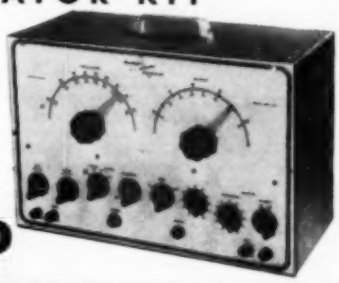
DC and AC voltage ranges 10 - 30 - 300 - 1000 - 5000V. Ohms range 0 - 3000 and 0 - 500,000. Range Milliamperes 0 - 10 Ma, 0 - 100 Ma. Easily assembled from complete instructions and pictorial diagrams.

$13.50

Model M-1
Shipping Wt. 3 lbs.

NEW *Heathkit*

T.V. ALIGNMENT GENERATOR KIT



Here is an excellent TV Alignment Generator designed to do TV service work quickly, easily, and properly. The Model TS-2 when used in conjunction with an oscilloscope provides a means of correctly aligning television receivers.

The instrument provides a frequency modulated signal covering, in two bands, the range of 10 to 90 Mc. and 150 to 230 Mc.— ALL ALLOCATED TV CHANNELS AS WELL AS IF FREQUENCIES ARE COVERED.

An absorption type frequency marker covers from 20 to 75 Mc. in two ranges—therefore, you have a simple, convenient means of frequency checking of IF's, independent of oscillator calibration.

Sweep width is controlled from the front panel and covers a sweep deviation of 0-12 Mc.—all the sweep you could possibly need or want.

And still other excellent features are: Horizontal sweep voltage available at the front panel and controlled with a phasing control—both step and continuously variable attenuation for setting the output signal to the desired level—a convenient instrument stand-by position—ferrite dust of both oscillator and marker tuning condensers—and blanking for establishing a single trace with base reference level. Make your work easier, save time, and repair with confidence—order your Heathkit TV Alignment Generator now!

Model TS-2
Shipping Wt. 20 lbs.

$39.50

YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER—USE ORDER BLANK ON LAST PAGE

ROCKE INTERNATIONAL CORP
NEW YORK CITY

The **HEATH COMPANY**

. . . BENTON HARBOR 15, MICHIGAN

Heathkit IMPEDANCE BRIDGE KIT



Model IB-1B
Shipping Wt. 15 lbs.

$69.50

This Impedance Bridge Kit is really a favorite with schools, industrial laboratories, and serious experimenters. An invaluable instrument for those doing electrical measurements work. Reads resistance from .01 Ohms to 10 meg., capacitance from .00001 to 100 MFD, inductance from 10 microhenries to 100 henries, dissipation factor from .002 to 1, and storage factor from 1 to 1000. And you don't have to worry about selecting the proper bridge circuit for the various measurements — the instrument automatically makes the correct circuit when you set up for taking the measurement you want. Bridge utilizes Wheatstone, Hay, Maxwell, and capacitance comparison circuits for the wide range and types of measurements possible. And it's self powered — has internal battery and 1000 cycle hummer. No external generator required — has provisions for external generator if measurements at other than 1000 cycles are desired. Kit utilizes only highest quality parts. General Radio main calibrated control, Mallory ceramic switches, excellent 200 microamp zero center galvanometer, laboratory type binding posts with standard ¾ inch centers, 1% precision ceramic-body type multiplier resistors, beautiful birch cabinet and ready calibrated panel. (Headphones not included.)

Take the guesswork out of electrical measurements — order your Heathkit Impedance Bridge kit today — you'll like it.

Heathkit LABORATORY RESISTANCE DECADE KIT



$19.50

Shipping Wt. 4 lbs.

An indispensable piece of laboratory equipment — the Heathkit Resistance Decade Kit gives you resistance settings from 1 to 99,999 ohms IN ONE OHM STEPS. For greatest accuracy, 1% precision ceramic-body type resistors and highest quality ceramic wafer switches are used.

Designed to match the Impedance Bridge above, the Resistance Decade Kit has a beautiful birch cabinet and attractive panel. It's easy to build, and comes complete with all parts and construction manual.

Heathkit LABORATORY POWER SUPPLY KITS

Limits:

No load	Variable 130-400V DC
25 MA	Variable 30-310V DC
50 MA	Variable 25-250V DC

Higher loads: Voltage drops off proportionally



$29.50

Model PS-1 Ship. Wt. 20 lbs.

Every experimenter needs a good power supply for electronic setups of all kinds. This unit has been expressly designed to act as a HV supply and a 6.3 V filament voltage source. Voltage control allows selection of HV output desired (continuously variable within limits outlined), and a Volts-Ma switch provides choice of output metering. A large plainly marked and direct reading meter scale indicates either DC voltage output in Volts or DC current output in Ma. (Range of meter 0-500V D.C., 0-200 Ma. D.C.) Instrument has convenient stand-by position and pilot light.

Comes with power transformer, filament transformer, meter, 5Y3 rectifier, two 6L6 control tubes, completely punched and formed chassis, panel, cabinet, detailed construction manual, and all other parts to make the kit complete.

Heathkit ECONOMY . . . 6 WATT AMPLIFIER KIT



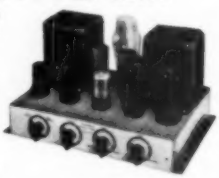
Model A-4
Ship. Wt. 8 lbs.

$12.50

No. 304 12 inch speaker . . . **$6.95**

This fine Heathkit Amplifier was designed to give quality reproduction and yet remain low in price. Has two preamp stages, phase inverter stage, and push-pull beam power output. Comes complete with six tubes, quality output transformer (to 3-4 ohm voice coil), husky cased power transformer and all other parts. Has tone and volume controls. Instruction manual has pictorial for easy assembly. Six watts output with response flat ± 1½ db from 50 to 15,000 cycles. A quality amplifier kit at a low price. Better build one.

Heathkit HIGH FIDELITY . . . 20 WATT AMPLIFIER KIT



$33.50

Shipping Wt. 18 lbs.

Our latest and finest amplifier — the model A-6 (or A-6A) is capable of a full 20 Watts of high fidelity output — good faithful reproduction made possible through careful circuit design and the use of only highest quality components. Frequency response within ± 1 db from 20-20,000 cycles. Distortion at 3 db below maximum power output (at 1000 cycles) is only 8%. The power transformer is rugged and conservatively rated and will deliver full plate and filament supply with ease. The output transformer was selected because of its exceptionally good frequency response and wide range of output impedances (4-8-16-150-600 ohms). Both are Chicago Transformers in drawn steel case for shielding and maximum protection to windings. The unit has dual tone controls to set the output for the tonal quality desired — treble control attenuates up to 15 db at 10,000 cycles — bass control gives bass boost up to 10 db at 50 cycles.

Tube complement consists of 5U4G rectifier, 6SJ7 voltage amplifier, 6SN7 amplifier and phase splitter, and two 6L6's in push-pull output. Comes complete with all parts and detailed construction manual. (Speaker not included.)

MODEL A-6: For tuner and crystal phono inputs. Has two position selector switch for convenient switching to type of input desired.

MODEL A-6A: Features an added 6SJ7 stage (preamplifier) for operating from variable reluctance cartridge phono pickup, mike input, and either tuner or standard crystal phono pickup. A three position selector switch provides flexible switching.
Shipping Wt. 18 lbs. **$35.50**

YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER—USE ORDER BLANK ON LAST PAGE

ROCKET INTERNATIONAL CORP. 11 E. 16th ST. NEW YORK CITY (16)

The HEATH COMPANY
. . . BENTON HARBOR 15, MICHIGAN

Heathkit RECEIVER & TUNER KITS for AM and FM



Model BR-1 Broadcast Model Kit covers 550 to 1600 Kc. Shipping Wt. 10 lbs.

Model AR-1 3 Band Receiver Kit covers 550 Kc. to over 20 Mc. continuous. Extremely high sensitivity. Shipping Wt. 10 lbs.



TWO HIGH QUALITY Heathkit SUPERHETERODYNE RECEIVER KITS

Two excellent Heathkits. Ideal for schools, replacement of worn out receivers, amateur and custom installations.

Both are transformer operated quality units. The best of materials used throughout — six inch calibrated slide rule dial — quality power output transformers — dual iron core shielded I.F. coils — metal cased filter condenser. The chassis has phono input jacks, 110 Volt output for phono motor and there is a phono-radio switch on panel. A large metal panel simplifying installation in used console cabinets is included. Comes complete with tubes and instruction manual incorporating pictorials and step-by-step instructions (less speaker and cabinet). The three band model has simple coil turret which is assembled separately for ease of construction.



Model FM-2
Ship. Wt. 9 lbs.

$22.50

TRUE FM FROM Heathkit FM TUNER KIT

The Heathkit FM Tuner Model FM-2 was designed for best tonal reproduction. The circuit incorporates the most desirable FM features — true FM.

Utilizes 8 tubes: 7E5 Oscillator, 6SH7 mixer, two 6SH7 IF amplifiers, 6SH7 limiter, two 7C4 diodes as discriminator, and 6X5 rectifier.

The instrument is transformer operated making it safe for connection to any type receiver or amplifier. Has ready wound and adjusted RF coils, and 2 stages of 10.7 Mc IF (including limiter). A calibrated six inch slide rule dial has vernier drive for easy tuning. All parts and complete construction manual furnished.



MAIL TO THE
HEATH COMPANY
BENTON HARBOR 15,
MICHIGAN

ORDER BLANK

From _____

SHIP VIA
- ☐ Parcel Post
- ☐ Express
- ☐ Freight
- ☐ Best Way

Quantity	Item	Price	Quantity	Item	Price
	Heathkit Oscilloscope Kit — Model O-7			Heathkit H.V. Probe Kit — No. 336	
	Heathkit VTVM Kit — Model V-5			Heathkit R.F. Signal Gen. Kit — Model SG-6	
	Heathkit FM Tuner Kit — FM-2			Heathkit Condenser Checker Kit — Model C-2	
	Heathkit Broadcast Receiver Kit — Model BR-1			Heathkit Handitester Kit — Model M-1	
	Heathkit Three Band Receiver Kit—Model AR-1			Heathkit Power Supply Kit — Model PS-1	
	Heathkit Amplifier Kit — Model A-4			Heathkit Resistance Decade Kit — Model RD-1	
	Heathkit Amplifier Kit — Model A-6 (or A-6A)			Heathkit Impedance Bridge Kit — Model IB-18	
	Heathkit Tube Checker Kit — Model TC-1			Heathkit A.C. VTVM-KIT — Model AV-1	
	Heathkit Audio Generator Kit — Model AG-7			Heathkit Intermodul. Analyzer Kit—Model IM-1	
	Heathkit Battery Eliminator Kit — Model BE-2			Heathkit Audio Freq. Meter Kit — Model AF-1	
	Heathkit Electronic Switch Kit — Model S-2			Heathkit Square Wave Gen. Kit — Model SQ-1	
	Heathkit T.V. Alignment Gen. Kit — TS-2				
	Heathkit Signal Tracer Kit — Model T-2				
	Heathkit R.F. Probe Kit — No. 309				

On Parcel Post Orders, include postage for weight shown and insurance. (We insure all shipments.)

On Express Orders, do not include transportation charges — they will be collected by the Express Agency at time of delivery.

Enclosed find ☐ Check ☐ Money Order for _____

Please ship C.O.D ☐ Postage enclosed for _____ lbs.

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

ROCKE INTERNATIONAL CORP
NEW YORK CITY

The HEATH COMPANY
...BENTON HARBOR 15, MICHIGAN

WINTER SALE
PRICES SLASHED

Don't Buy Tubes until you get our prices. Quantities Limited. Prices Subject to Change Without Notice. Low Prices.

GLASS RADIO & TELEVISION TUBES

These prices apply only on orders for 12 or more tubes. Orders for less than 12, write for quotation

1B3—	$ .88	6BA6—	$ .63	AX6—	$ .48
1L4—	.68	6BA7—	.85	12AT6—	.53
1R5—	.70	6BE6—	.63	12AT7—	.99
1S5—	.70	6BG6—	1.18	12AU6—	.88
1T4—	.70	6BM6—	.70	12AU7—	.78
1U4—	.68	6BQ6—	1.10	12AX7—	.85
1U5—	.68	6CB6—	.70	12BA6—	.78
3Q4—	.78	6CD6—	1.65	12BE6—	.62
3S4—	.78	6C4—	.66	19BG6—	1.78
3V4—	.78	6S4—	.72	19T8—	.99
6AK5—	1.38	6SD7—	.98	25BQ6—	1.10
6AL5—	.68	6SK7—	.70	25L6—	.68
6AQ5—	.68	6SN7—	.78	35C5—	.68
6AT6—	.58	6T8—	1.08	50C5—	.68
6AU6—	.68	6V6—	.68	117Z3—	.58
6AV6—	.58	6W4—	.64	5085—	.71

All Other Types at Vast Reductions

Westinghouse Bypass Rectifier G-64 Amp. 20 Volts, Reg. $11.00 ea. Special $1.95
TUBE SALE—#'s AT-35-27-85-31-50-57. Mix Mixed Ass't. 6 of Any Type 2.25
12 BRAND NEW 10" PHONO RECORDS—Ass't. Jazz—Popular. Please specify $5.75
Ringle Pote—10 Pos. 2 Gang Switch 29c
2 pairs, 5 pole Male and Female separable Amphenol plugs with Flex. shielded cables. Approx. 5 ft. long. 39c pair ..... 3 pr. for $1.00
Grind your own Crystals. Pure Brazilian Quartz. Vari sizes and thicknesses. 1g lb. pkg $1.00
4 Tube Drilled Chassis, 4½"x6½"x1½". 29c each 25 LOTS OF 815 ..... 25c each
4 inch P.M. SPEAKER $1.50
5 in. 450 ohm Dynamic Speaker $1.35
Signal Corps Phones—2 M. Ohms 8 M. Ohms Imp. $1.25
2 Ft. Ext. Cord (and Plug) 40c
2 MFD—1000 V Upright Bottom Lug Oil Cond. 99c

TOBE TUBULAR ELECTROLYTICS

20-20 MFD. 150 V. 49c 30-30 MFD. 150 V. .57c
40-40 MFD. 150 V. 69c

Low-Loss Short Wave Lock Type Air Trimmer Variable Condensers



5 Pf.—20Mmfd. 14c
7 Pf.—25-30 Mmfd. 15c
8 Pf.—30-35 Mmfd. 18c
14 Pf.—56 Mmfd. 24c

3 GANG T.R.F. VARIABLE CONDENSERS 0003365 Cap. 49c

D.P.D.T. SLIDE TOGGLE SWITCH 19c

4 PR. WAFER SOCKETS—$1.49 per C. ea-ch. 3c
5-8 PRONG WAFER SOCKETS ..... $3.50 per C
100 ASST SOCKETS—4-5-6-7 ..... $1.98 per C
1,000 OHM WIRE WOUND POTENTIOMETER 19c
30 HY-FILTER CHOKE SHIELDED ..... 2 for $1.25
UNSHIELDED ..... 3 for 1.00
2,000 ohm Wire Wound Rheostats ..... $1 per doz.
CARTER WIRE WOUND G.T. VARIABLE 20 OHM RESISTORS ..... 35c per doz.

PIEZO CRYSTAL HOLDERS. 12 for $1.00—$6.00 per hundred—$50.00 per 1,000

RCA Band Switches—
3 gang, 3 pos. 9 band 30c 6 gang, 4 pos. 4-5 band 49c

Trimmer-Padder Asst.—all isolantite—singles, dual-triples—100 asst. pieces $3.39

Philco push button Rotary Switch Double Pole 39c

ATTENTION Prospectors, Explorers for Hidden Treasures! Location of U.S. Army Type of Metallic Mine Detector Amplifier. Amplifier unit only less tubes and batteries with cables, headphone cord, and jack. Approx. wiring diagram. Type AN PRS-1 ..... $1.98

RCA Ass't Mica By-Pass Cond. .001 100 for ... 99c
6 or 9 Gang Push Button Switch 49c

DRILLED CHASSIS FOR 5-6 tubes 5 x10"x1½" 25c
PHONE JACKS—OPEN & CLOSED AUTO. 19c
6½" SPEAKER VOL. CONTROL—no OHMS 19c
SALE—PHONO RECORD ALBUMS—2"—3 comp. 19c 10"—3 comp.—29c; 4 comp. 39c; 12 comp. 49c

6 Prong Amphenol Sockets ..... $4.00 per C

AMERTRAN FILAMENT TRANSFORMER—6.3 V. 1 Amp. Encased Isolantite Terminal Posts $1.95

VULCAN HEAVY DUTY 100 WATT SOLDERING IRON Built for U.S.N.—Brand New—Entire outfit for $6.50 ..... OUR PRICE $2.99

AMERTRAN AUDIO OUTPUT XFORMER—Pri. 10,000 @ 15 MA. Sec. 300Ω, 8-1 Ratio $1.49

AMERTRAN MIXER AUDIO XFORMER—Pri. 600-10,000 Ohms $1.00

100-1 RATIO VERNIER DIALS—4 in. 5g in. Hub 35c

LINE VOLTAGE NOISE ELIMINATOR—Plugs in Between Radio and Elec. Socket 35c

HEARING AID CORDS—Assortment of 12 for $1.00

BY-PASS COND. ASST—25 Cans, Roba, Paper, etc. $1.00

MINIMUM ORDER $3.00—NO C.O.D.
SHIPMENTS—PLEASE INCLUDE POSTAGE

NEWARK SURPLUS MATERIALS CO.
Dept. MA
324 Plane Street NEWARK 1, N. J.

CHECK THAT PICTURE TUBE

By

F. C. KROEGER

Details on a simple adapter that can be used in conjunction with your regular tube tester.

ONE of the most useful and handy devices for the TV technician is a means for checking the picture tube. TV has been in our community two and a half years and we are beginning to have an increasing number of kinescope replacements due to length of service as well as the seemingly early failure of the rectangular types. These faults may often appear as trouble in some other section of the receiver and after wasting time in a vain attempt to repair the set CRT substitution is resorted to in a last effort. Remember, as a service technician your time is your most precious commodity. It must be utilized intelligently if you are to realize your maximum profit.

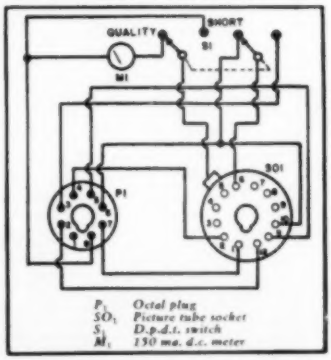
Kinescope troubles may be divided into the following categories: burned out filaments and defective picture screen are both visible to the eye when the set is in operation; shorts and leakage, defects in the electron gun may often be found with an ohmmeter, but most likely are only present when the cathode is heated. The most difficult trouble to spot without a kinescope checker is, of course, low emission. If this is suspected and you have no checker your only recourse is tube substitution. There are now several excellent makes of checkers on the market, but by using a special adapter, I have found that my conventional tube checker will give equal results. Not only has this spared me the expense of a separate CRT checker, but also eliminates one more item to be carried in the car or truck. This adapter will work, not only with our conventional magnetic type tubes, but also with the new electrostatic focus tubes such as the 17FP4. However, no attempt has been made to check electrostatic deflection tubes, as we have found that customers are no longer interested in repairing this type set when it involves a major expenditure.

Because anode current is so very low and the meter in the conventional tube checker (we use a *Hickok*) is one ma. or more it is necessary to use an external meter with a sensitive 150 to 200 microampere movement. The schematic of this adapter is self-explanatory. I use an octal plug hooked to a regular kinescope socket with a 150 microampere meter in series with the accelerating anode lead. The switch is used for checking the new type electrostatic focus tubes for shorts and to protect the meter during short tests. When the switch is in "quality" position, pin 6 of the picture tube socket is connected to pin 10. I selected the 6SK7 setting of my tube checker to provide the necessary voltages to the picture tube socket. The operation of the adapter is quite simple.

First, set your tube checker for a 6SK7 with the "bias" setting (*Hickok* only) on 35, "English" on zero, and the "micromhos" switch control to "English". The bias for a 50 degree deflection type tube must be set at 25 instead of 35. Then, without removing tube from chassis, connect the tube to the checker through the adapter. The adapter switch should be on "short test". Allow a reasonable warm up period, then check for shorts. If there are none, throw the adapter switch and check for anode current. I usually remove the ion trap because we have found that if it is improperly set, readings are often false. The anode current of a new tube should be 100 microamperes plus or minus ten per-cent. A tube is still usable from 40 to 60 microamperes. You may set up your own standard of good, bad, and doubtful by taking readings on sets going through your own shop. Be sure your filament switch is at 6.3 volts and not left on 35 or 50 volts from checking an a.c.-d.c. blooper.

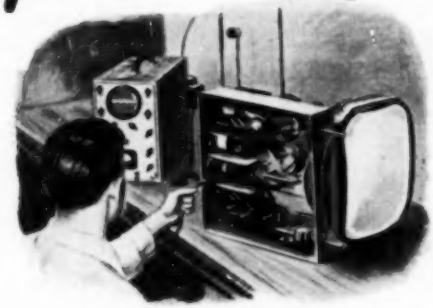
This adapter is quite simple to make and will repay you many times for the slight effort necessary. While this one was used for my own particular make of tube checker it may be used with any other that checks the individual tube elements. Good luck and faster servicing! —30—

Wiring diagram of the simple adapter used with a tube tester to check the kinescopes.



P1 Octal plug
SO1 Picture tube socket
S1 D.p.d.t. switch
M1 150 ma. d.c. meter

Here's your Opportunity



to prepare for a good job or a business of your own in TV SERVICING

There are today more good jobs open in TV Servicing than there are trained and experienced men to fill them. Yes, thousands of opportunities exist now for good-pay jobs offering employment security for years and years to come. Thousands of TV Servicing jobs are going begging. Do you want one of them?

Experts agree, that because of the critical shortage of trained and experienced TV Servicemen, and the tremendous future growth of the industry, no vocational field today offers more opportunities than TV Servicing.

The Big New Industry with a Great Future

Television is just in the beginning stages of its big industrial boom. Look at these amazing facts:

- Lifting the freeze on new TV stations will open many new TV areas and will improve the coverage of existing areas. The result will be an enormous demand for TV receivers.
- Within a few years over 1000 TV stations will be telecasting compared with 108 TV stations now on the air.
- Nearly one-half of all families living within the present TV areas do not yet own TV receivers.
- The new trans-continental video network plus better and more interesting programs plus larger viewing screens and color TV will increase the installation of new receivers, will induce present owners of 12-inch and smaller size viewing screens to buy newer model receivers.
- The power increases of many existing stations and improved reception range of current receivers will result in receivers being installed and serviced in the fringe areas of present stations.
- Under the FCC proposal, over 70 per cent of all communities will be served by UHF channels exclusively. This means TV servicemen must know UHF receivers before the new UHF stations in their area are opened.
- No one yet knows how great the industrial TV market will be.

RCA Institutes Home Study Course prepares you for a Career in TV Servicing

The addition of the RCA Institutes TV Service Training to your present radio-electronics experience will qualify you to step out and grasp the golden opportunities that now exist in television—America's fastest growing industry.

Learn at home—in your spare time—while you study the practical *how-to-do-it* techniques with *how-it-works* information. Easy-to-read and easy-to-understand lessons under the supervision of RCA engineers and experienced instructors quickly train you to qualify for the many good jobs now waiting for trained TV servicemen. Don't pass up this lifetime opportunity for financial security and a bright future in TV. Learn TV Servicing from RCA—pioneers and leaders in radio, television and electronic developments.

RCA Institutes conducts a resident school in New York City offering day and evening courses in Radio and TV Servicing, Radio Code and Radio Operating, Radio Broadcasting, Advanced Technology. *Write for free catalog on resident courses.*

Send for FREE BOOKLET

Mail the coupon—today. Get complete information on the RCA INSTITUTES Home Study Course in Television Servicing. Booklet gives you a general outline of the course by units. See how this practical home study course trains you quickly, easily. Mail coupon in envelope or paste on postal card.



MAIL COUPON NOW!

RCA INSTITUTES, INC., Home Study Department RH-352
350 West Fourth Street, New York 14, N. Y.

Without obligation on my part, please send me copy of booklet "RCA INSTITUTES Home Study Course in TELEVISION SERVICING." (No salesman will call.)

Name_____
(please print)

Address_____

City_____ Zone_____ State_____

RCA INSTITUTES, INC.
A SERVICE OF RADIO CORPORATION of AMERICA
350 WEST FOURTH STREET, NEW YORK 14, N.Y.

COMPLETE TV CONICAL ANTENNA KIT
—Nothing More to Buy

STOCK NO. AU-67

$16.99

Latest model Genuine Aircraft Aluminum Tubing

Everything you need to erect a high-gain 10-element finished TV antenna

"X" type antenna. HERE'S WHAT YOU GET: 1 stacked deluxe 20 element conical antenna with high frequency stubs (2 3/8, steel mast sections, 1 11/16 approved tubular lightning arrester, 1 steel antenna mounting assembly with necessary strapping, 75 ft. 300 ohm twinline, 6 insulated screw-eye standoffs, and 4 insulated mast standoff insulators.

Your antenna has a normal pattern providing high gain on ALL channels. All the necessary installation parts are packed with the antenna. Here's the professional material at hand for that installation. Order Home Kits NOW. This is real Olson Value. Shpg. wt. 25 lbs.

STACKED CONICALS FULL 20 ELEMENT

IN LOTS OF 3, EACH **$7.99**

With matching Q bars and High Frequency Stubs. Genuine Aircraft Aluminum elements. High gain stacked conical. Will pull in those stations in "Fringe Areas." Works on all channels. Easily assembled.

THIS IS A TERRIFIC VALUE!

Each Antenna consists of two matching bars plus a pair of matching Q bars. Less than 4 lbs. Packed—3 Antennas to a carton. This gives you six bays and 3 pairs of Q bars.

Set 6 Only in Boxes of 3 Antennas AU-66. Carton of 3. Weight 25 lbs.

$23.97

TWIN LINE

300 Ohm Poly Twinline

High quality, low loss. For all TV and FM 10-station installations. Shpg. wt. 2 lbs.

Stock No. W-73. 100 ft. coil. Lots of 10, ea. Single, ea. **$1.99** **$2.09**

OPEN WIRE TV LINE

★ Use in Place of 300 Ohm Line

Ideal for fringe area installations. Not affected by moisture or rain. Made of #18 weatherproof wire with genuine polystyrene insulators spaced 6" apart. Tensile strength 300 lbs.

Stock No. W-78. 150ft. coil. Shpg. wt. 4 lbs. **$8.98**

Stock No. W-79. 250ft. coil. Shpg. wt. 7 lbs. **$14.90**

OLSON SMASHES KINESCOPE PRICES!
Every Tube Brand New and Guaranteed

16GP4A	Round, Dark Face, Metal Envelope. Retail Price $51.00.	$24.95
17B4PA	Rectangular, Dark Face, Glass Envelope. Retail Price $17.50.	19.95
19AP4B	Round, Etched Dark Face, Metal Env. Retail Price $45.00.	29.95
20CP4	Rectangular Dark Face, Glass Envelope. Retail Price $59.00.	29.95

Here are real bargains in Picture Tubes. Prices which would be impossible except that Olson made a cash deal on THREE SOLID RAILROAD CARS full of BRAND NEW TUBES. This is one of the biggest deals that has been going around here for a long time. We had to make one promise when we bought this deal. We promised not to advertise the manufacturer's name. However every tube is in the original carton and bears the manufacturer's name.

BIG VALUES AT OLSON'S

Stock No.	Description	Olson's Price
T-80	TV Focus Coil. Replaces RCA 202D1. For magnetically deflected 90° Kinescopes.	$1.79
T-90	TV Focus Coil, EM-PM Type. Used on 16"-70° and 19"-90° Kinescopes.	$2.98
T-91	Ion Trap with 2 powerful Alnico 5 magnets. Bronze clamp keeps it firm.	.98
X-263	Ion Trap single magnet type. Most popular in use. Order plenty.	.49
T-94	GE Type Universal Flyback Trans. similar RTC-085, 7721 for all 65°-70° Kinescopes. Ferrite core. Supplies 14,000 volts. Single ea. $3.99. Lots of 3, each.	$3.49
T-93	70° TV Yoke. Similar to RCA 209D1. Use on Kinescopes up to 19" single ea. $3.49. Lots of 3, each.	$2.99
T-82	90° TV Flyback Trans. Similar to RCA 211T1. For all 19" and 12" Kinescopes. Single ea. $2.99. Lots of 3, each.	$1.99
T-84	90° TV Yoke. Similar to RCA 208D1. For 19" to 16" Kinescopes. Single ea. $2.79. Lots of 3, each.	$1.99
C-256	500 MMFD 10KV Ceramic TV Condenser. With threaded terminals. Single ea. 79¢. Lots of 10, each.	.49
C-399	900 MMFD 20KV Ceramic TV Condenser with threaded terminals. Single ea. 99¢. Lots of 10, each.	.85
R-14	TV Carbofilm Resistor. 2 meg. For practically all TV sets.	.59
W-75	TV Anode Connector. Phosphor Bronze prng, rubber shield and polyethylene cord.	.49
X-197	JFD Lightning Arrester. UL approved. For all 300 ohm TV lines.	$1.32
X-207	TV Antenna Chimney Mount. Attaches to chimney. Takes mast 3/4" to 1 1/4" diam.	$1.79
X-165	Recording Wire. Stainless Steel. Excellent frequency response. 1/4 hr. spool.	$1.98
X-166	Recording Wire. Stainless steel. Excellent frequency response. 1 hr. spool.	$2.98
Y-41	Recording Discs. 6" size Aluminum base, smooth coating. Pkg. of 5 discs.	$1.20
Y-42	Recording Discs. 8" size Aluminum base, smooth coating. Pkg. of 5 discs.	$1.50
Y-43	Recording Discs. 10" size Aluminum base, smooth coating. Pkg. of 5 discs.	$2.40
W-53	AC Lamp Cord. Zips apart. 2 conductor copper tough insulation. 250° spool.	$4.99
K-14	Speaker Baffle. For 5" and 6" speakers. Sloping front. Fine walnut finish.	$3.45
K-15	Speaker Baffle. For 8" speakers. Sloping front. Fine walnut finish.	$3.95
K-16	Speaker Baffle. For 10" speakers. Sloping front. Fine walnut finish.	$4.45
K-17	Speaker Baffle. For 12" speakers. Sloping front. Fine walnut finish.	$5.45
AS-44	Volume Control Kit. Contains 10 popular single, dual controls. Many with switch.	$2.99
AS-45	Condenser Kit. Contains between 40 and 50 electrolytic and by-pass condensers.	$3.95
X-191	Service Call Tags. 3 sections, claim check, identity, billing, with wires. Per 100.	$1.19

Build a Receiver Set of Basic Components

W/1 of 9 parts — AS-39

$1.89

You get this kit of 5 basic parts to build an AC-DC set portable.

Parts	Reg.	List Price
Loop		$2.95
R.F. Coil		1.10
I.F. Transformer (456 KC- Input		1.50
Output		1.85
Oscillator Coil		.75
List Price of Set		8.00

Use any 365 mfd variable for tuning. Covers 535-1625 KC.

PRESTO—Call Intercom
The Modern Electronic Communication System

Stock No. RA-06. Olson Special Price for Master Station, Substation and 50 ft. of cable only.

$19.83

Now talk with anyone anywhere at the mere flick of a button! All electric master station and substation give clear, powerful voice reproduction to rooms or other buildings up to 1000 ft. away. Thousands have been sold for use in restaurants, on farms, in offices, stockrooms, factories and in homes. Just plug master station into any 115 V AC electrical outlet—connect 3 wires and you're operating! Modern design. Each unit measures 4 1/2 x 6 1/4 x 5 1/2. Equipped with rubber feet and easy slide switches. Handsome appearance-gray crackle finish. High amplifier—one 3 tubes. Power output 2 watts. Regular list price is $37.50. You get the master station, substation and 50 ft. of 2 conductor cable. Complete with tubes. Shpg. wt. 8 lbs.

IT'S OLSON FOR SPEAKERS

Don't hesitate—here's that opportunity to buy quality speakers at less than jobbers cost. Again Olson was there on the spot. We had the cash and made the deal. Now you can get your share of the Speaker Giveaway.

Stock No.	Size	Wt.	Price	Use
S-4	4"	1 lb.	$1.69	All-wave
S-5	5"	2 lb.	1.79	PM
S-6	6"	2 lb.	2.29	with built-in
S-8	8"	3 lb.	3.39	3.2 Ω
S-10	10"	5 lb.	4.98	output
S-123	8"	3 lb.	3.09	transformer
S-124	10"	5 lb.	4.98	voice
S-167	12"	7 lb.	4.98	coils

DO YOU LIVE IN A TV FRINGE AREA?

- **Amazing manufacturer's close-out**
- **Regular retail price $32.50**

Model No. 107—Complete with tubes. Ready to work. Not a kit.

$10.95

Continuous tuning for TV and FM through all channels. Coils wound with PURE SILVER wire. Improves TV reception and reduces noise and "snow." Housed in beautiful plastic case 5 1/2 x 7 1/2 x 5. Tube is 6J6 push-pull triode amplifier. Operates on 115 volts. In original factory sealed carton. Shpg. wt. 5 lbs.

PHONO CARTRIDGES

Take your pick of these two types of cartridges . . . Astatic Ceramic or Astatic Variable Reluctance magnet. Both are bargains. Get yours while they last.

Astatic LQD Turnover Model

Stock No. XC-46. Single, ea. **$3.98** Lots of 10 $3.50 ea.

Popular "turnover" Type crystal cartridge for 33⅓, 45 and 78 RPM discs. Excellent frequency response 30-7500 cycles. Equipped with 2 precious tip needles which are removable. Stamped aluminum housing with needle guards, mounting bracket and turnover knob. Reg. list price is $10.00.

G-E Magnetic Cartridges Triple Play—RPX-050

Stock No. $5.99 each list price $13.95.

Variable reluctance cartridge that plays all records. Equipped with Sapphire-tipped needle .001" tip for 33⅓ and 45 RPM. Also .003" tip for 78 RPM. Requires preamplifier. Not affected by humidity and high temperatures. Supplied with knob to fit most spindles. Complete with dual needle. Reg.

12" Wide Range Co-Axial Speaker — CLOSE-OUT

★ 40 to 17,000 CPS Response

Special close-out price while they last

Stock No. S-180

$10.95

MAKE WAY FOR NEW MODEL

Closing out reg. $32.50 retail hi-fi, 2-unit speaker. Thousands sold at $13.95. This is the same type of speaker you will find in $300.00 console models. Each speaker consists of a 12" woofer section driven by a heavy 2 lb. magnet and this part delivers the bass notes. The 3" tweeter speaker is built into the center of the speaker and is driven by a 2.15 oz. Alnico 5 magnet delivering the treble notes. High pass filter is built into speaker and entire combination gives tones never dreamed possible. Only two wires to connect to any radio or amplifier and speaker is ready to play. Voice coil impedance is 8 ohms. Shpg. wt. 10 lbs.

BUILD YOUR OWN VIBRATOR POWER SUPPLY

Build your own Vibrator power supply and get 150 volts DC from any 6 volt storage battery. Use it to furnish "B" power for portable radios, aircraft and marine receivers. Ideal for experimenting. No tube needed. In this kit you get:

1 Mallory Type 45 sync. Vibrator
1 Power Transformer

These are the main components. A simple diagram is included so you can build the supply easily in less than half an hour. The Mallory vibrator fits a standard 5 prong socket and the can measures 1 1/2 x 3 1/4. This is the same as Mallory number 245. The transformer is fully shielded and measures 1 3/4 x 1 3/4 x 2". The genuine Mallory vibrator lists at $7.70 and the transformer at $5.00. Shpg. wt. 3 lbs.

Stock No. K-272—You get both for only. **$1.49**

INDISPENSABLE—Sam's Photofact Books

Photofact Television Course. Covers TV principles, operation and practice. 210 pages; profusely illustrated; 8½ x 11". Order TV-1. Only **$3.00**

Television Antennas. New 2nd edition. Describes all TV antenna types; tells how to select, install, solve troubles. Saves time, helps you earn more. 200 pages; illustrated. Order TAS-1. Only **$2.00**

Television Tube Location Guide. Volume 2. Accurate diagrams show position and function of all tubes in hundreds of TV sets. Helps you diagnose trouble without removing chassis. 224 pages, pocket-size. Order TGL-2. Only **$2.00**

Television Tube Location Guide. Vol. 1. Over 200 pages of TV receiver tube position diagrams on hundreds of TV models. Order TGL-1. Only **$1.50**

1949-1950 Record Changer Manual. Vol. 3. Covers 44 models made in 1949-50 including multi-speed changers and wire and tape recorders. Original data based on actual analysis of equipment. 280 pages, 8½ x 11", paper-bound. Order CM-3. Only **$3.00**

1948-1949 Changer Manual. Vol. 2. Covers 45 models made in 1948-49. Paper bound. Order CM-2. Only **$4.95**

1947-1948 Changer Manual. Vol. 1. Covers 40 post-war models up to 1948. Order CM-1. Only **$3.95**

Audio Amplifiers. Vol. 3. Clear, uniform, accurate data on 50 important audio amplifiers, plus full coverage of 22FM and AM tuners, produced during 1950. 362 pages, 8½ x 11". Order AA-3. Only **$3.95**

Audio Amplifiers. Vol. 2. A complete analysis of 104 well-known audio amplifiers and 12 tuners made 1948-50. 368 pages, 8½ x 11". Order AA-2. Only **$3.95**

Audio Amplifiers. Vol. 1. 102 amplifiers and FM tuners made through 1948. 334 p. Order AA-1. Only **$3.95**

Auto Radio Manual. Complete service data on more than 100 post-war auto radio models. Covers over 24 mfrs. 350 pages, 8½ x 11". Order AR-1. Only **$4.95**

Radio Receiver Tube Placement Guide. Accurate diagrams show where to replace each tube in 5500 radio models, covering 1938-1947 receivers. 192 pages, pocket-size. Order TP-1. Only **$1.25**

Dial Cord Stringing Guide. Vol. 2. Covers receivers made from 1947 through 1949. Shows you the one right way to string a dial cord in thousands of models. Pocket-size. Order DC-2. Only **$1.00**

Dial Cord Guide. Vol. 1. Covers sets produced 1939 through 1946. Order DC-1. Only **$1.00**

OLSON RADIO WAREHOUSE • 275 E. Market St., Akron 8, Ohio

10-WATT WIRE-WOUND RESISTORS



Stock 28-16

Olson bought over $64,000 worth of these fine wire wound resistors a famous manufacturer's entire stock. You can have them at 80% discount off list price. Stock up. Order whether you need them now or not. Regular list prices run from 75¢ to $1.10 each. These resistors are unaffected by heat, cold, or fumes. Winding is rigidly held in place on asbestos core by special clamps. Stands terrific overloads. Accuracy 10%. FULLY GUARANTEED. Equipped with tinned leads.

20¢ EA. Olson's Special

TAKE YOUR CHOICE WHILE THEY LAST

Available in the Following Resistances.

OHMS	OHMS	OHMS	OHMS	OHMS
5	50	390	1250	3,000
10	100	750	1500	4,000
25	135	800	1750	7,000
33	150	1000	2000	7,500
35	200	1100	2250	8,000
40	225	1300	2500	9,500
				10,000
				11,000
				12,000
				12,500
				13,500
				14,300
				15,000
				16,000

30 WATT AMPLIFIER



- Factory Built
- Latest Design

Olson's Price less tubes. RA-23 ..... **$34.95**

A real commercial amplifier which looks good and performs well. Not a kit. Gain, mike, 110dB; phono, 80dB. Has dual tone controls, one for bass (from 30 to 1500 cps) and the other for treble tone. 8, 15 and 500 ohms. Input for two mikes and one crystal pickup. Shpg. wt. 20 lbs. Tubes required, 4-6SQ7, 1-6SC7, 2-6L6G, 1-5Y4G.

FAIRCHILD GRINDER



TL-3 **$9.98**

Every service shop needs one of these handy tools made by Fairchild, famous manufacturer of precision electric grinders. Regular nationally advertised price is $19.75. The set consists of 1—115 volt high speed, air cooled grinder, 6 assorted grinding wheels, 1 circular saw blade, 1 hardened steel reamer, 1 buffing brush, 1 abrasive stone and a natural finish wood case size 10"x5"x3" to house the grinder. Shipped in original factory sealed cartons.

4-DRAWER STEEL CABINET GIVEN WITH OLSON'S GIGANTIC, NEW AKRAD KIT



Olson's Price AS-20 **$16.95**

You get $51.60 list worth of "Akrad" Electrolytic Condensers plus the 4 drawer steel cabinet FREE, size 10"x 11½"x16". Shpg. wt. 45 lbs.

42 "AKRAD" By Pass Condensers

Qty	Cap.	Volts	List ea.	Total
2	.001	600	$.25	$.50
2	.002	600	.25	.50
2	.005	600	.30	1.50
5	.01	600	.30	1.50
5	.02	600	.30	1.50
10	.05	600	.40	4.00
10	1	600	.45	4.50
2	.005	1600	.55	1.10
2	.008	1600	.55	1.10
2	.01	1600	.60	1.20
69 Value				$51.60

Also 27 "AKRAD" Electrolytic Condensers

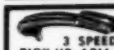
Qty	Cap.	Volts	List ea.	Total
2	10	25	$1.00	$2.00
2	25	25	1.00	2.00
5	20	150	1.20	6.00
5	40	150	1.35	6.75
6	20-20	150	1.65	9.60
5	8	450	1.25	6.25
4	16	450	1.40	5.60
27 Value				$44.20



AS-46 KIT OF 30 **$2.49**

10 WATT RESISTOR KIT

We mean to move 30,000 fine 10 watt wire wound resistors during this sale. REGULAR LIST PRICE OF THIS KIT IS $15.00. Each kit contains 20 popular insulated resistors, with tinned copper leads. Shpg. wt. 2 lbs.



3 SPEED PICK-UP ARM

M-44 **$4.95**

Cartridge flips by means of lever. Dual cartridge, one side plays 33⅓ and 45 and other 78 RPM. Double needle.



MIKE

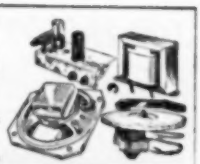
High output crystal mike for PA systems and recording. Equipped with handle and 7' shielded cable. Shpg. wt. 5 lbs.

M-97, each **$5.95**

M-66, same but with on-off switch built into handle **$6.95**

BUILD YOUR OWN RECORD PLAYER

★ Kits available now from Olson. Choose from 2 Models.



Each Kit contains a rim drive motor with velvet finish turntable, crystal pickup, all purpose needle, 6" PM speaker, matching output transformer, 2 tube AC-DC amplifier complete with tubes (35W4 and 50B5).

Single Speed Model 78 RPM		3 Speed Model 33⅓-45-78 RPM	
Complete Kit as described above. Shpg. wt. 8 lb.	Stock No. AS-53 $8.95	Complete Kit as described above. Shpg. wt. 8 lb.	Stock No. AS-53 $11.95

FAMOUS BRAND 3-SPEED AUTOMATIC $19.99 RECORD CHANGER



AS-60

- Sorry, we promised not to mention the manufacturer's name.
- Automatically Plays 7", 10" and 12" Records.
- Plays All Type Discs—All Speeds 33⅓, 45 and 78 RPM.

Completely automatic and what's more it's one of the most famous brands in changers. Precision built by experienced craftsmen. Every changer brand new in original factory packing, 100% guaranteed to please or your money back. Here is one of Olson's most sensational bargains. Believe us—you can't go wrong. Order one or more but we can't promise to repeat this offer. We have a limited quantity and when they are gone—no more.

The changer has a reject lever and a control for selecting 33⅓, 45 or 78 RPM speeds. Plays all 7", 10" and 12" records. Equipped with an Astatic Ceramic cartridge and a sapphire long life needle. Records drop gently and smoothly—just like velvet. Operates on 115 volts, 60 cycles AC. Base 12⅛x12⅛". 5⅛" above plate and 3½" below. Shpg. wt. 15 lbs.



BIGGEST BARGAIN

COMBINATION OFFER—You get an Allstate Rim Drive 78 RPM Phono Motor with turntable PLUS a Pickup Arm with high Output Cartridge.

Special while they last for the combination **$3.99** RA-91



3 SPEED MOTOR

Self starting, complete with turntable. Operation on 115 volts AC 60 cy. Shpg. wt. 5 lbs. **$5.99**

RIM DRIVE Stock 28-83



PHONO AMPLIFIER

RA-19 **$3.98** LESS TUBES

A real high efficiency 3-tube amplifier of modern design. Connect to any crystal phono arm and speaker. Has volume and tone controls 2"x 3½"x2". Shpg. wt. 2 lbs.

SET OF TUBES FOR AMPLIFIER 12SQ7 50L6 35Z5 No. AS-22 **$2.64**

3 SPEED AUTOMATIC CHANGER



RA-70 **$42.95** WHILE THEY LAST

COMPLETE with VM Model 950 Changer, Amplifier, Speaker and Case. At real Olson value if we ever saw one! Here is the latest VM Model 950 Automatic Changer built into a beautiful carrying case with speaker and fine Amplifier. Plays twelve 7" records (33⅓s or 45 RPM); twelve 10" or ten 12" (33⅓s or 78 RPM). 100% automatic in operation. Nothing more to buy when you order this fine player from OLSON. The cartridge is equipped with a long life needle. Motor shuts off after last record. Equipped with volume control and tone control. Speaker is Alnico V PM. Carrying case is beautifully covered. Size 15" x 13" x 8". For 115 volts 60 cy. AC. Regular list price $77.95.



THIS COSTS YOU NOTHING—NOT A RED CENT

Just to get the ball rolling and to get your order coming our way—Olson is giving away one of its famous TUBE SOCKET KITS. The kit contains 20 popular assorted 6-7-8-9 pin sockets which can be used for AM-FM and TV work. To get this kit all you need do is make up an order for $10.00 or more from this ad—use the order blank below. We will ship your order at once and include the 20-piece socket kit—FREE.

RECORDING TAPE—Famous Mfr's Close-Out!



Get the buy of your life. Save up to 64% on high quality RECORDING TAPE. A large manufacturer had to sell his inventory and he unloaded the whole deal. Olson now offers you this high grade recording tape at prices which defy competition. Standard 1/4" wide. 1200 ft. long. Frequency response 50 to 8,000 cy. Plastic Reel included with each.

PAPER BASE— 1200 ft. Stock No. X-248 Single, each $1.69 Lots of 10, each **$1.49**

PLASTIC BASE 1200 ft. Stock No. X-249 Single, each $2.10 Lots of 10, each **$1.99**

PRICES SLASHED ON EMPTY PLASTIC REELS

Finest Clear Plastic—Will Not Warp

5" Diameter—600' Size No. X-250 Single, ea. 39¢. LOTS OF TEN, EA. ..... **29¢**

7" Diameter—1200' Size No. X-251 Single, ea. 49¢. LOTS OF TEN, EA. ..... **39¢**

NOTICE—RADIO MANUFACTURERS

● Olson Radio has established a tremendous market among radio servicemen, amateurs, universities and industrials all over America as well as principal foreign countries. A tremendous rapid mailing service in the talk of the trade.

If you have any good, clean surplus radio material which you wish to dispose of, contact Olson at once. We can use: radios, amplifiers, condensers, chassis, phono motors, pickup arms, volume controls, test equipment, speakers, in fact any radio or electronic part or piece of equipment.

Here is your opportunity to turn idle inventory into cash. Write, wire or call Olson, the popular name in radio.

SEND FOR OLSON'S BRAND NEW BARGAIN CATALOG. GET NATIONALLY FAMOUS RADIO PARTS AND SUPPLIES AT BIG DISCOUNTS

CLEVELAND, OHIO
2020 Euclid Ave.
If you live in or near Cleveland visit our store, get these and many more bargains.

CHICAGO, ILLINOIS
623 W. Randolph Street
If you live in or near Chicago visit our store, get these and many more bargains.

MAIL ORDERS SHOULD BE SENT TO AKRON, OHIO

IT'S EASY TO ORDER FROM OLSON'S

How to order: Order directly from this ad. For convenience use this order blank. Fill in columns below with quantity desired, stock number, description and price. You may send remittance with order (include enough for postage or parcel post shipment), or if you prefer SEND NO MONEY. Olson will ship C.O.D. and you may pay mail or expressman for merchandise and postage.

MONEY BACK GUARANTEE: *Everything you order from Olson is guaranteed as advertised. If you are not more than satisfied, you may return merchandise for cash refund.*

Please Minimum Order $3.00

QUANTITY	STOCK NUMBER	DESCRIPTION	PRICE EACH	TOTAL

NAME _____

ADDRESS _____

CITY _____ ZONE ____ STATE ____

RN 353

TOTAL

ADD POSTAGE

TOTAL AMOUNT

OLSON RADIO WAREHOUSE • 275 E. Market St., Akron 8, Ohio

LOW FACTORY PRICES

Sensationally New For 1952!

MIDWEST Television and 5 Wave Band **RADIOS**

MAMMOTH **20-INCH** Rectangular PICTURE

EASY TERMS

Beautiful custom cabinets for every installation in your own cabinet

10 DAYS TRIAL—FACTORY-TO-YOU

WE PAY TRANSPORTATION CHARGES.

Special Bonus Gift!

Illuminated **TELEVISION CLOCK**

Given With Every Purchase of a MIDWEST RADIO or TELEVISION

LIMITED TIME ONLY!

Phone For FREE 1952 MIDWEST CATALOG

IN NEW YORK MUrray Hill 2-6810 IN CHICAGO STate 2-5800
IN CLEVELAND PRospect 1-7050 IN PITTSBURGH GRant 1-6800
IN DETROIT WOodward 3-1232 IN ST. LOUIS GRand 1161
IN PHILADELPHIA LOcust 4-1035 ... or send coupon below

SEND THIS COUPON For FREE MIDWEST 1952 Catalog

MIDWEST RADIO & TELEVISION CORP.
Dept. 378 909 Broadway, Cincinnati 2, Ohio

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

GROUND RADIO OPERATORS AND RADIO TECHNICIANS

TRANS WORLD AIRLINES

First or Second phone license required. Ground Radio Operators, able type 35 words per minute, needed several domestic stations. Radio Technicians needed Kansas City Base and should have two years experience radio repair. Write RTN-TWA, Employment Manager, Kansas City 6, Missouri.

THIS AD MAY BE SMALL—BUT IT CAN MEAN B-I-G MONEY TO YOU!

I want to buy BC-348, BC-342, BC-312, ARC-1, ART-13, BC-221 or any parts thereof, no matter how small. In fact, I'll buy anything. I'm not kidding! Let me prove it!

Wire or write: ROBERT SANETT
4668 Dockweiler, Los Angeles, Calif.
Telephone: YOrk 4637

Within the Industry

(*Continued from page 26*)

Starrett Television Corporation of New York. He was formerly special consultant to the company's board of directors in the fields of procurement and finance . . . **WILLIAM W. TAYLOR** is the new sales promotion manager of the Capacitor Division of *Sangamo Electric Company*. He will make his headquarters at the Marion, Illinois, plant of the firm . . . **MANFRED E. PHILIP** has been appointed controller and director of purchases for *Telrex, Inc.* . . . **MARTIN F. SHEA**, veteran *Philco* employee, has been named vice-president of the Auto-Radio Division in charge of car radio manufacturing sales and head of the company's Detroit operation . . . **DAVID S. RAU** has been elected vice-president and chief engineer of *RCA Communications, Inc.*, while **C. W. LATIMER**, formerly vice-president in charge of engineering, has been named vice-president and chief technical consultant of the firm . . . **S. I. NEIMAN** has been named executive secretary of Radar-Radio Industries of Chicago, Inc., while **KENNETH C. PRINCE** has been retained as general counsel of the trade group . . . **EDWARD A. ROPPEL**, quality control engineer at *Packard-Bell Company*, has assumed his new post of supervisor of government production . . . **MARVIN L. BRUCKNER** has been named assistant sales manager of the jobber division for *Quam Nichols Co.*, Chicago speaker and electronics manufacturer.

* * *

ALBERT COUMONT has been appointed service manager of the Radio-Television Manufacturers Association, succeeding E. W. Merriam who held the post previously on a temporary basis.

Mr. Coumont was formerly sales manager, Electronics Section, *International General Electric Co., Inc.* and prior to that gained wide experience in his own service business and in the service divisions of various manufacturers.

He will make his headquarters at the new RTMA offices, 777 14th St., Washington 5, D. C.

* * *

DOUGLAS Y. SMITH, veteran of nearly a quarter-century of service in the engineering, merchandising, and sales activities of *RCA*, has been promoted to the post of manager of sales operations for the Tube Department of *Radio Corporation of America*.



Earl M. Wood, for the past 10 years manager of manufacturing at the Tube Department's Lancaster, Pa., plant, will succeed Mr. Smith as plant manager in Lancaster.

In his new post Mr. Smith will be responsible for the coordination of the department's renewal and equipment sales activities and of the tube parts and machinery sales.

He joined the company as a tube design engineer in 1930, shortly after his graduation from Cooper Union College.

—30—

NEATER DRILLING

By MORRIS DORSEY

NEATER, quicker drilling of aluminum, metal, and plastic can be accomplished by placing a small piece of cellophane tape over the spot to be drilled.

The tape seems to provide a "bite" for the drill point and at the same time prevents the usual burrs which have to be reamed or filed out. In addition, the tape keeps the drill from slipping and marring an otherwise good-looking panel.

—30—

Largest Selling Booster

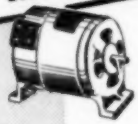
AT ANY PRICE !



Regency

BURTON BROWNE ADVERTISING

SPECIAL MOTORS



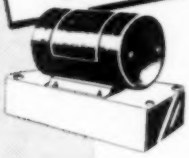
SELSYNS



DYNAMOTORS



POWER UNITS



BLOWERS



THIS EQUIPMENT IS THE FINEST AVAILABLE, BUILT BY LEADING MANUFACTURERS AND UNCONDITIONALLY GUARANTEED BY WELLS. MANY TYPES NOT LISTED ARE IN STOCK. SEND US YOUR REQUIREMENTS FOR IMMEDIATE QUOTATION.

MOTORS AND SELSYNS

MANUFACTURER	TYPE OR NO.	VOLTAGE	RPM	DIMENSIONS	SPECIAL INFORMATION
Stewart Warner		6VDC		2¼"x2½"	¼"x½" Lg. shaft
John Oster	B-9-2	12VDC 1.4A	5600	2¼"x3⅛"	¼"x⅝" Lg. shaft. Shent Wd.
General Ind.	62800	13VDC 9A	6800	2¼"x4"	¼"x⅝" Lg. shaft. 1.12 HP
Emerson	D-26-BT	24VDC 24A	100	2¼"x5½"	160 Ft.-Oz. torque
Redmond	7-N	24VDC .96A	6000	2⅛"x3¼"	Complete blower assembly
F. A. Smith	40m	115VAC 60 Cy		6"x5½"x5"	180 CFM blower ($12.95)
Western Elect.	FL	115VAC 400 Cy	6700	3¼"x4"x4½"	25 CFM blower
Signal Elect.	D-4272	24VDC .66A	2100	2¼"x2⅛"	⅛"x1" shaft. 1.100 HP
Stromberg	D-4496	24VDC .45A		2½"x3¼"	⅛"x½" shaft. .003 HP
Amglo		24VDC		1½"x2⅛"	Telephone ringing circuit motor
John Oster	A-168-26R	26VDC		1½"x2⅛"	1/16"x⅜" shaft. Series Rev.
John Oster	DEST-8-1R	27VDC 1.4A	3800	2¼"x4¼"	⅛"x⅝" shaft. 1.40 HP
Delco	5069267	27.5VDC .25A	6000	1¾"x2½"	⅛"x1⅛" shaft. 1½ Oz-In Tq.
Western Elect.	K55996-L04	28VDC		2"x2½"	1/16"x⅜" shaft. Series Rev.
Bendix	MD5B	28VDC 1.75A	3200	1½"x2½"	⅛"x1⅛" shaft. Series Rev.
Bendix	E-11500-1	28VDC 1A	9000	1½"x2½"	⅛"x1⅛" shaft. Series Rev.
Fractional Mtrs.	SH-280	28VDC 3.1A	3900	3¼"x5½"	¼"x⅝" shaft. Used in ART 13
Electrolux	20100	28VDC .1A		2"x2"x⅝"	1/16"x⅜" shaft. 20 Deg. rotation
John Oster	A-21-E-12R	28VDC .4A		1½"x2⅛"	1/16"x⅜" shaft. Series Rev.
Emerson	D-26-BV	28VDC 3.1A	3900	2½"x3¼"	⅛"x⅝" shaft. 1.20 HP
Electrolux	16876	28.5VDC 1.8A	2200	3¼"x5"	⅛"x1⅛" shaft. 1.35 HP
General Elect.	2J1G1	57.5VAC 400 Cy		2¼"x3¼"	Selsyn transmitter
General Elect.	5BN38HA10	60VDC .25A	3000	2⅛"x5½"	⅛"x⅝" lg. shaft
General Elect.	2J1F1	115VAC 400 Cy		2¼"x3"	Selsyn generator
Diehl	11-1	110VAC 60 Cy		4"x5½"	Synchro repeater selsyn
Bendix		110VAC 60 Cy		3¼"x5½"	Synchro differential selsyn
Bendix		110VAC 60 Cy		3¼"x5½"	Synchro transmitter selsyn

DYNAMOTORS AND POWER UNITS

MANUFACTURER	TYPE OR NO.	INPUT	OUTPUT	DIA.	LGTH.	SPECIAL INFORMATION
Eicor	ML3415-254	27.5VDC 1.5A	250VDC .060A	4"	8½"	With bracket mounting
Eicor	ML3412-42	13.8VDC 2.45A	220VDC .070A	3½"	5⅛"	No mounting
Western Elect.	DM53AZ	14VDC 2.8A	220VDC .080A	2⅛"	4½"	With base plate
Westinghouse	1171187A	27VDC 1.4A	295VDC .060A	2⅛"	4½"	No mounting
General Elect.	5DY82AB52	27VDC 1.5A	285VDC .060A	2⅛"	4½"	No mounting
Western Elect.	1171091B	27VDC 1.6A	285VDC .075A	2⅛"	4½"	No mounting
Redmond	5047	27VDC 1.75A	285VDC .075A	2⅛"	4½"	No mounting
Eicor	ML3415-254	27.5VDC 1.5A	100VDC .150A	3½"	5½"	With base plate
Eicor	ML3420-194	27.5VDC 4.0A	325VDC .200A	3⅛"	6½"	With base plate
C.Q.R.	355D2BA	27.9VDC 1.25A	220VDC .070A	3⅛"	5⅜"	No mounting
Continental	DM310A	28VDC .5A	100VDC .01A	2⅛"	4½"	No mounting
C.A.V.	DM32A	28VDC 1.1A	250VDC .060A	2⅛"	4½"	With base plate
Pioneer	PE8EM	28VDC 1.25A	250VDC .060A	2⅛"	4½"	With base and filter
Bendix	DA-1A	28VDC 1.6A	230VDC .100A	3⅛"	5⅛"	No mounting
Redmond	DM5 3A	28VDC 1.4A	220VDC .080A	2⅛"	4½"	With base plate
Redmond	5056	28VDC 1.4A	250VDC .060A	2⅛"	4½"	With base plate
Eicor	ML-3420-90	28VDC 3.3A	400VDC .125 A	3½"	6½"	With base plate
Continental	DM33A	28VDC 5A	575VDC .160A	3½"	7⅛"	Cont. duty. No mounting
Winco	4136	13VDC 13A 13VDC	250VDC .060A 300VDC .225A	4"±	8⅛"	With base plate Intermittent
Continental	DMX310A	12VDC 2.8A	150VDC .100A	2⅛"	4½"	Cont. Duty. No mounting
				DIMENSIONS		
Pioneer	PE 55	12VDC .16A	500VDC 0.2A Cont.	7⅛"x12⅛"x13½"		Pwr. Unit W/DM 19G DYN. Filter and Mounting
Westinghouse	PE 94C	28VDC 10.5A	300VDC .260A 150VDC .010A 14.5VDC 10A	8¼"x6½"x12½"		Pwr. Unit W/DA3A DYN. Filter and Mounting

ADEL CLAMPS—LARGE STOCK—SEND US YOUR REQUIREMENTS

CHECK WELLS' HUGE STOCK FOR IMMEDIATE DELIVERY OF QUALITY COMPONENTS AT SUBSTANTIALLY LOWER COST

- Resistors • Condensers • Wire and Cable • Relays
- Co-ax Connectors • Rectifiers • Transformers • Chokes
- Micro Switches, Toggles • Antennas • Accessories
- Electronic Assemblies • Dial Light Assemblies

SEeley 8-4143

MANUFACTURERS AND DISTRIBUTORS: WRITE FOR CATALOG

ORDER DIRECT OR THROUGH YOUR LOCAL PARTS JOBBER

WELLS SALES, INC.

833 W. CHICAGO AVE., DEPT. R CHICAGO 22, ILL.

NEW DYNAMIC

Dynaset*

BY TELEX



MONOSET*
Original under chin headphone of high impedance. Magnetic.



Telex DYNASET*

NEW UNDER-THE-CHIN DYNAMIC HEADPHONE

Built for user comfort and top quality reception, the Telex Dynamic Dynaset is popular in both offices and Radio-TV studios because it provides clear reproduction of both speech and music. Its higher fidelity range brings more lows and highs to your ears making it especially desirable for all types of telecasting and radio monitoring.

Secretaries appreciate its lightweight (1.25 oz.) and comfortable under-the-chin styling for office transcription use. Dynamic driver in plug makes anodyzed aluminum tone arms extremely lightweight.



EARSET*
Single-phone headset that slips onto the ear.



TWINSET*
CAA approved headset that rests lightly on sides of head. Nothing touches ear.



Write on your business letterhead for a complete TELEX Dynaset which will be sent to you on a 20-day Approval Plan.

TELEX hearing at its best

ELECTRO-ACOUSTIC DIV. • DEPT. E-16
TELEX PARK — ST. PAUL 1, MINN.
In Canada, Atlas Radio Corp., Toronto
STANDARD OF THE WORLD FOR QUALITY HEADSETS

*TRADEMARK

SELL Jensen PHONO NEEDLES For Any Type Record Player

Please send me FREE Jensselector. Picks the proper replacement needle.

Name _____

Address _____

City _____ State _____

Jensen Industries, Inc., 336 S. Wood St., Chicago 12

EASY TO LEARN CODE

It is easy to learn or increase speed with an Instructograph Code Teacher. Affords the quickest and most practical method yet developed. For beginners or advanced students. Available tapes from beginner's alphabet to typical messages on all subjects. Speed range 5 to 40 WPM. Always ready—no QRM.



ENDORSED BY THOUSANDS!

The Instructograph Code Teacher literally takes the place of an operator-instructor and enables anyone to learn and master code without further assistance. Thousands of successful operators have "acquired the code" with the Instructograph System. Write today for convenient rental and purchase plans.

INSTRUCTOGRAPH COMPANY

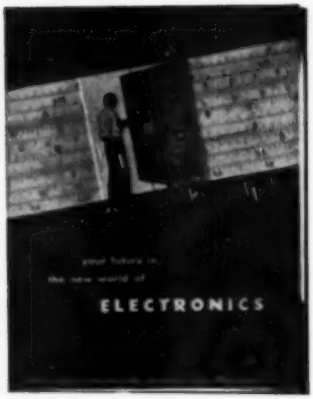
4711 SHERIDAN ROAD, CHICAGO 40, ILLINOIS

nected firmly to the chassis which is tied to the separate electrical ground at some point. Instability or regeneration often shows up in the form of distorted audio and critical tuning. The previously mentioned procedure of shunting the tuned circuits with resistances of from 50,000 ohms to .5 megohm often tends to reduce these effects, but likewise lowers the gain of the system and makes tuning broader.

It is usually considered that high selectivity means lower noise in reception. There seems to be at least one possible exception to this, however, as far as AM reception is concerned. Noise, consisting of single pulses, will tend to shock excite tuned circuits, producing a damped wave train of a duration depending upon the "*Q*" of the circuit. A rough relationship appears to be that a coil with a "*Q*" of ten will ring for ten cycles before the amplitude level drops to one-tenth of its initial value. As a result, the "hangover" produced by highly selective tuned circuits may cause noise impulses, when detected, to fall well within the audio range, while in the case of low "*Q*," broadly tuned circuits the resultant noise may fall largely in the ultrasonic range and is therefore not as objectionable even though of considerably greater amplitude than would be the case with a highly selective system. Consequently, the author prefers relatively low "*Q*" input circuits as a means of reducing audible noise in the reception. In the tuner design shown this appeared to work very well, with background noise and hiss being reduced to a low level with the audio gain control fully open.

In conclusion, it seems that a dual channel tuner represents a good solution to the problem of enjoyable reception of amplitude modulated signals. It is simple both in design and construction and requires no elaborate equipment for alignment and adjustment. —30—





How far ahead can you be next year . . .

IN TV AND ELECTRONICS?

◀ Send for this free CREI booklet today... and find out!

THIS BOOKLET can mean the difference between small, w-i-d-e-l-y s-p-a-c-e-d salary increases—and rapid advancement. Between routine work—and challenging opportunity. Between constantly defending your job against better-trained men—and dynamic confidence. Between short-circuited hopes—and high-powered ambition.

An exciting new world has opened up with such superspeed that even the most optimistic electronic experts fall short in their predictions of expansion.

Think of the 1,500 TV stations within the next 5 years and the 2,500 stations within 10 years, as predicted by the Chairman of the FCC. Think of the 13,000,000 TV sets now in use. *Remember that we weren't supposed to reach that figure until 1954.* Think of the 100,000,000 radios in current operation. (95% of the nation's homes have one or more sets.) Think of the tremendous defense orders now being placed for electronic equipment and installations.

Think of the thousands of radio-equipped fire and police departments throughout the U.S. Of the many radio-equipped railroads, of the hundreds of cities with 2-way radio service for cars and cabs. Think of the wide-ranging field of aviation communications—radio-controlled aircraft, navigation-and-traffic control, airport stations.

Think of the maritime world with its navigational aids, fathometers, ship-to-shore and ship-to-ship communications and radar. Think of electronic heating, fax and ultra-fax, of electronic medicine, and all the other applications of electronic know-how.

Countless positions must be filled—in development, research, design, production, testing and inspection, manufacture, broadcasting, telecasting and servicing. Who will get those positions? You—if you prepare today—if you are alert and have the ambition to advance your knowledge. You—if you take 2 minutes to send for a free copy of "Your Future in the New World of Electronics."

This helpful book shows you how CREI Home Study leads the way to greater earnings through the inviting opportunities described above.

However, being an accredited technical school, CREI does not promise you a "bed-of-roses." You have to translate your willingness to learn into saleable technical knowledge—via *study*. Since its founding in 1927, CREI has provided thousands of professional radiomen with technical educations. During World War II, CREI trained thousands for the Armed Services. Leading firms choose CREI courses for group training in electronics at company expense, among them United Air Lines, Canadian Broadcasting Corporation, Trans Canada Airlines, Sears Roebuck & Co., Bendix Products Division, All-American Cables and Radio, Inc., and RCA-Victor Division.

CREI courses are prepared by recognized experts, in a practical, easily-understood manner. You get the benefit of time-tested materials, under the personal supervision of a CREI Staff Instructor. This complete training is the reason why CREI graduates find their diplomas keys-to-success in Radio, TV and Electronics. CREI alumni hold top positions in America's leading firms.

At your service is the CREI Placement Bureau, which finds positions for students and graduates. Although CREI does not guarantee jobs, requests for personnel currently exceed supply by far.

Talk to men in the field and check up on CREI's high standing in electronics instruction. Determine for yourself right now that your earnings are going to rise with your knowledge—and that you get your rightful place in the Age of Electronics. All this CREI can promise you, provided you sincerely want to learn. Fill out the coupon and mail it today. We'll promptly send you your free copy of "Your Future in the New World of Electronics." The rest—the future—is up to you.

MAIL COUPON FOR FREE BOOKLET

CAPITOL RADIO ENGINEERING INSTITUTE
Dept. 1130, 16th & Park Rd., N.W., Washington 10, D. C.

Send booklet "Your Future in the New World of Electronics" and course outline.

CHECK FIELD OF GREATEST INTEREST
- ☐ TV, FM & Advanced AM Servicing
- ☐ Practical Television Engineering
- ☐ Broadcast Radio Engineering (AM, FM, TV)
- ☐ Practical Radio Engineering
- ☐ Aeronautical Radio Engineering

Name .....

Street .....

City ..... Zone ..... State .....

If residence school in Wash., D. C., preferred, check here ☐

IT'S HERE! McGee New 1952 Model 12 Inch Coaxial Speaker for $12.95

BUY YOUR WIDE-RANGE COAXIAL SPEAKER AT McGEE



NEW 1952 MODEL
12" COAXIAL P.M.
$12.95
WHY PAY MORE?

McGee offers its new 1952 model 12" coaxial PM speaker. The finest that we have ever offered. Quality you would put in your finest sets if you were a manufacturer. Alnico V magnet. 8 ohm or the 12" woofer. The tweeter is musically matched to the woofer and is factory pre-set and attached. The high pass filter is concealed under the pot cover. Only wires to connect to output tube or radio or audio amplifier. Why buy an ordinary speaker when you can have a 12" coaxial for only $12.95? Handles 20 watts peak and 10 watts average. Shipping weight 8 lbs. Response from 50 to 17,500 cps. McGee's finest speaker value. Stock No. CC-14U. Sale price $12.95 each.



15" COAXIAL P.M. SPEAKER
$19.95

only $19.95 buys a full 15" 20 watt coaxial PM speaker, with built-in high pass filter. Hook to any 8 ohm radio or amplifier. Response from 40 to above 17,500 cps. Good bass response. A hefty purchase makes this price possible. Full 15" woofer, tapped to the woofer. Tweeter. Model E15-20. Ship. wt. 11 lbs. Sale price $19.95.

HALLICRAFTERS S-78
11-TUBE FM-AM CHASSIS

ONLY **$89.50** LESS SPEAKER

WITH 12" COAXIAL SPEAKER **$99.50**

★ PUSH-PULL WIDE RANGE AUDIO

Hallicrafters S-78, 11-tube AM-FM radio receiver chassis, with push-pull 6K6 high fidelity audio system. Has model eight tuning. Illuminated dial. Full range tone control with bass boost. Input for automatic record changer. Output transformer has 8 ohm and 500 ohm connections. Chassis size 12½" x 8½" x 7" high. Knobs and escutcheon are gold finished. Receives standard broadcast and FM. 88 to 108 mc. Shipping weight 25 lbs. Model S-78, priced less speaker at **$89.50** net. Hallicrafters 11-tube AM-FM chassis with 12" coaxial PM speaker, both for **$99.50.** S-78 with 15" coaxial PM speaker, both for **$107.95.**

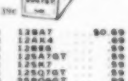
If you want a record changer, see our special listing below. If changer with variable reluctance cartridge is desired, add **$8.95** for a pre-amplifier, as the S-78 is designed for use with a crystal pick-up.



DELUXE CAPEHART CABINET $99.95

Beautiful, top quality, walnut combination radio-phono cabinet. 42" high, 42" wide and 22" deep. Made for Capehart's finest combination. Highly polished matched walnut panels. Cabinet top is 1¼" thick. This cabinet weighs approximately 180 lbs. Both the radio and changer compartments and speaker grill have hinged doors. Radio compartment on the right-hand side is 14" high and 11½" wide. Made to mount chassis vertically. The changer compartment is 14" high and 26½" wide. Large enough to hold any record changer or recorder mechanism. Front 10" of top over the changer compartment is hinged to fold back for easy access to the changer. Both radio and changer compartments come with uncut panels. Speaker baffle is cut for a 12" speaker, completely grilled. Shipping weight, 475 lbs. Stock No. K-475. Capehart combination cabinet. Net price, **$99.95**

ELECTRONIC RADIO and TV TUBES



- 6 MONTHS' GUARANTEE
- INDIVIDUALLY CARTONED
- IN RED AND BLUE DE LUXE VARNISHED CARTONS
- EVERY TUBE SET TESTED FOR YOUR PROTECTION

ORDER 50 ASSORTED—TAKE 10% OFF. Prices as Low as 3¢

024	$0.50	6AV6	$0.40	6SA7GT	$0.50	12BA7	$0.60
1N34GT	.50	6BA6	.50	6SK7	.50	12AK6	.60
1S4	.50	6BE6	.50	6SL7GT	.50	12BE6	.60
1S5	.50	6BC5	.50	6SN7GT	.50	12SA7GT	.60
1U4	.50	6BG6G	1.50	6U8	.75	12SK7	.60
1U5	.50	6BH6	.50	6V6GT	.50	12SQ7GT	.60
1X4	.50	6BJ6	.50	6W6GT	.50	25B6GT	.60
1X5	.50	6BQ6GT	.60	6X4	.40	25L6GT	.60
5U4G	.40	6C4	.40	6X8GT	.40	35C5	.50
5Y3GT	.40	6CB6	.50	6Y6G	.50	35W4	.40
6AB4	.60	6CD6G	1.50	12AT7	.60	35Z5GT	.50
6AK5	.60	6H6GT	.40	12AU6	.50	50B5	.60
6AL5	.40	6J5GT	.40	12AV7	.60	50C5	.60
6AQ5	.50	6L6G	.50	12AX7	.60	50L6GT	.60
6AT6	.60	6S4	.50	12BA6	.50	117Z3	.60
6AU6	.50						

3-SPEED CHANGERS ON SALE at McGEE



WEBSTER CHICAGO 3-SPEED
Regular $47.50 List Only **$24.95**

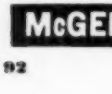
Webster Chicago Model 100-16 3 speed automatic record changer with crystal cartridge and all speed Sapphire needle. Plays 10" records. Base size 12x12¾". Shipping weight 14 lbs. This offer good only as long as our stock lasts. A special purchase makes this offer possible. Webster Chicago 3 speed changer, Model 100-16. Sale price **$24.95.**

WEBSTER CHICAGO MODEL 100-2 ONLY $26.95

For the first time we offer the world famous Webster-Chicago, model 100-2. Features a newly designed spindle that drops the records flat, air-cushioned to the turntable. Picks up automatically after the last record plays. Plays all records, intermixed automatically. 33⅓, 78 and 45 rpm. New balanced tone arm with Electro-Voice 710-A Matic cartridge with dual needles. Ordinarily not over **$37.00.** McGee offers them for only **$26.95** each. Base size 12"x12¾". Shipping weight 14 lbs.

V.M. 3-SPEED MODEL 406 $22.95

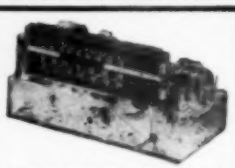
VM model 406, deluxe 3 speed automatic record changer. Plays them all, intermixes records of the same speed. Equipped with a flip over crystal pickup with twin needles. Base size, 12¼x13". Shipping weight 12 lbs. VM-406. Net price **$22.95.**



GENERAL INSTRUMENT 3-SPEED $19.95

Another tremendous McGee record changer scoop. Only 500 to sell. General Instrument, 3 speed automatic record changer with standard crystal cartridge and all purpose permanent needle. Brand sparkling new. Our first offering of a 3 speed changer at less than $20.00. We purchased a large quantity and pass the saving on to you. Stock No. GI-3384. Sale price **$19.95** each. Price to the small manufacturer in lots of 48 or more, **$18.50** each.

New Versatile Espey
12-TUBE FM-AM CHASSIS
$64.50



★ BUILT IN PRE-AMPLIFIER FOR G.E. VARIABLE RELUCTANCE PICKUP
★ WIDE RANGE AUDIO
★ MAY BE USED WITH A CRYSTAL MIKE AS A HOME P.A. SYSTEM

McGee's new 1951 model 12 tube FM/AM chassis. Latest design with phono inputs for all types of record players, crystal or G.E. variable reluctance. Receives standard broadcast 550 to 1700 KC and FM 88 to 108 MC. Wide range audio response (push-pull 6K6) and bass boost tone control. Loop antenna for broadcast and 300 ohm line type antenna, may be stapled to cabinet. Attractive lighted slide rule dial. Chassis size 13½" x 9" x 7" high. Shipping weight 20 lbs. **Stock No. CC-64.** Matches sell at a much higher price. McGee's sale price is **$64.50**, less speaker output transformer. **7-CK** chassis with 12" coaxial PM, 15 watt, both **$74.50.** Espey 7-C chassis, 12" coaxial PM speaker and 3 speed VM changer with G.E. variable reluctance cartridge, **$134.95.**



TERRIFIC RADIO-PHONO SALE
12-TUBE ESPEY CHASSIS
2—12" P.M. SPEAKERS
$200.00 VALUE WALNUT CABINET
GE 2-SPEED CHANGER
$179.95

Buy this combination offer and have a fine radio-phono combination for less than the value of the cabinet alone. This beautiful walnut cabinet was intended for a Capehart $800.00 combination and for the finest radio furniture. Made of solid mahogany veneers. 37" high, 40" wide and 21" front to back. Hinged top lifts to let sections open for changer. Changer mounts on the changer compartment and 14½" covers the radio compartment. Changer mounting board is included. Finished panel is shipped ready cut to fit the Espey 7-C chassis. Twin heavy duty 12" PM speakers are furnished. Changer is a G.E. General Electric 33⅓ and 78 rpm, 2 speed automatic changer with two plug-in G.E. Variable reluctance cartridges. Stock No. MEH-175 complete. Espey 7-C chassis, 2 speed G.E. changer and 2 12" speakers. Sale price, **$179.95.** 3 speed VM changer with G.E. variable reluctance turnaround cartridge furnished for $15.00 extra. Shipping weight 200 lbs. Shipped via truck, rail or express only.
Capehart cabinet described above, furnished cut to fit the Espey 7-C chassis, cabinet only **$75.95.**



100 Molded Plastic Bypasses **$9.95**

100 molded plastic tubular bypass condensers. All 600 volt. And all by the same nationally known mfgr. Regular dealers' cost is over two and one-half times our 20th Anniversary sale price. You'll chuckle when you look these over. Here's what you get: 10-.001, 10-.002, 20-.005, 20-.01, 10-.02, 10-.05 and 10-.1. Our big deal No. BN-202. 100 plastic tubulars. Shipping weight 2 lbs. Net price **$9.95.**



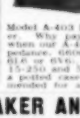
100 600 VOLT TUBULARS **$6.95**

100 top quality 600 volt tubular by-pass condensers. Made this year by a famous condenser factory. Don't confuse these with grab-bag surplus. McGee's deals are guaranteed to please you. Here's what you get: 10-.001, 10-.002, 20-.005, 20-.01, 10-.02, 20-.05 and 10-.1 600 volt condensers. Our big deal No. BN-203. Shipping weight 2 lbs. Net price **$6.95.**



50-W. OUTPUT TRANS.
ONLY **$7.50** WHY PAY MORE

50-watt super quality high fidelity output transformer. Matches push-pull parallel or push-pull 6L6 tubes to 4-8, 16 ohm voice coil, also 60 and 250 ohm line. Very efficient winding construction only 140 ohms total resistance in primary and 9 ohms resistance in secondary. Secondary will carry up to 10 amps. This output transformer makes a minimum ohms value for 25 watts of audio power due to heat loss within the transformer. Very ideal for public address systems. Stock No. 50-IB, net weight 5½ lbs. Bargain price **$7.50** ea., 2 for **$13.95.**



McGee's Super High Fidelity Best Value in U. S. A.
OUTPUT TRANS. 20-20,000 CPS.
$7.95

Model A-403 High fidelity output transformer. Why pay $20 or $30 for an output, when our A-403 is available at $7.95? Impedance ratios a minimum ohms value for PP 6L6 or 6V6. 10% feedback winding. 4-8-15-250 and 500-600 secondary. Wound in a potted case. Net weight 6 lbs. Recommended for all amplifiers up to 34 watts.



10" SPEAKER AND BAFFLE $6.95

Stock No. CA-10. Tan leatherette covered plywood slant type wall baffle, plus 10" Permadhm 8 ohm PM speaker. Only a few hundred to sell at **$6.95** each, or **$6.25** each in lots of 3 or more.

SPEAKER AND BAFFLE SALE
8" SPEAKER AND BAFFLE $4.95

Stock No. 818. Tan leatherette covered, plywood slant type wall baffle, plus an 8" Oxford, 4.5 oz. magnet PM speaker. A real hot Motive special for only **$4.95** each, or **$4.70** each in lots of 3 or more.

12" SPEAKER AND BAFFLE $6.95

Stock No. CA-12. Tan leatherette covered plywood slant type wall baffle, plus a 12" Quam, 4.64 oz. Alnico V magnet PM speaker. 3.16 oersted flux density. A terrific McGee value for only **$6.95** each, or **$6.60** each in lots of 3 or more.

50-WATT BOOSTER AMPLIFIER—$39.95



28-Watt Horn $29.95



50-Watt Booster $39.95



3-Mike Pre-Amp. $10.00 Extra.

50-WATT BOOSTER A sensational value. 50 watt booster amplifier with push-pull parallel 6L6 output tubes. Designed for remote control of your present 25 watt booster as a booster or use with the PR-2X Pre-amp to add the use of 2 mikes and one low level input. The booster amplifier has one input jack and with 1 volt input gives 50 watts of audio. Booster has a 6 ft. potted cable with high fidelity output transformer, matches speaker with 4-8-16 ohm voice coil, also 60 ohm and 250 ohm line. Booster has a 225 volt power supply with 5U4 rectifier. Price includes tubes 2-6L6, 1-6SN7 and 1-5U4. The two variable controls are for master volume control and base boost tone control. Size 8 x 6½ x 14½. Stock No. PA-55X. Shipping weight 26 lbs. Sale price **$39.95** ea.

2-MIKE PRE-AMP. Pre-amplifier plugs in directly to the PA-55X Booster amplifier. It enables use of 2 Crystal or Dynamic Mikes plus one low level input. Furnished with 6 foot cables and plugs for remote control of your 25 watt booster amplifier. Small chassis size 5 x 3½ x 4". Stock No. PR-2X, with tubes 7F7 and 7N7. Net price **$10.00** ea.

25-WATT HORN 25-Watt Driver and 31½-foot air column re-entrant Trumpet. The standard type trumpet and driver you see the most. Drivers are 100% weatherproof, horn is spun aluminum, offered to you at a considerable savings. Stock No. MA-33. Shipping weight 20 lbs. Net price **$28.95.**

McGEE RADIO COMPANY

Prices F.O.B. K.C. Send 25% Deposit with Order. Balance Sent C.O.D. With Parcel Post Orders, Include Postage

TELEPHONE VICTOR 9045. WRITE FOR FLYER. 1422 GRAND AVE., KANSAS CITY, MISSOURI

ALWAYS LOOK TO McGEE FOR UNCOMPARABLE VALUES!



R.C.A. $9.95 | Type 3 Sarkes-Tarzian $9.95 | Type 2 Sarkes-Tarzian $7.95 | R.C.A. Printed Circuit $19.95 | General Inst. $2.95

RCA TV FRONT END WITH TUBES $9.95

Terrific buy on this RCA TV tuner. We have a limited quantity of the famous original 2o1E1, 12 channel completely wired and tested TV front end tuners. Ready to connect to your TV video I.F. strip. Offered at a sacrifice. Price was originally $44.95, now only $9.95 each, with tubes. You'll save plenty on this item. No. RCA-13P TV front end tuner. Shaft length 3⅜" from base of tuner. Converter coil type for separate sound, as used in the famous 630 chassis. Net price $9.95 each, two for $19.90, complete with 3-6J6 tubes.

SARKES-TARZIAN TYPE 3-TUNER WITH TUBES $9.95

This popular Sarkes-Tarzian TV front end is widely used today. 13 channel rotary type switch with individually tuned coils. Price includes a schematic diagram and 3 tubes; 6C4 osc., 6BH6 RF and 6AG5 mixer. Regular factory cost is twice our price. Each tuner and its own tube sockets are wired, ready to hook up to a video and sound IF strip. May be used with either inter-carrier or separate sound IF circuits. Built in fine frequency control. Shipping weight 3 lbs. Type 2 Sarkes-Tarzian TV tuner with tubes. Net price $9.95. Type 3 tuner and 205-XX video coil kit, both for $16.95.

SARKES-TARZIAN TYPE 2-TUNER WITH TUBES $7.95

Type 2 Sarkes-Tarzian TV tuner, same as Type 3 listed above, except does not have input IF coil built on. Complete with 3 tubes. Net price $7.95. Type 2 tuner and 205-XX video coil kit, both for $14.95.

RCA 12-CHANNEL PRINTED CIRCUIT TV TUNER $19.95

Latest design RCA 12 channel printed circuit TV tuner. Rotary switch with snap-in printed circuit strip principle. This popular tuner used by Hallicrafters in inter-carrier circuit sets. Shaft length 3⅜". Built in fine frequency control. Price includes 3-6J6 and 6CB6. A terrific value at $19.95 each.

GENERAL INSTRUMENT TV TUNER, LESS TUBES $2.95

Completely wired, 12 channel selector incorporating fixed inductance and variable capacitance. Connector output transformer is attached. To be coupled direct to separate sound and video IF's, 3-6J6 tubes are required. Shaft length 2⅝". Built in fine frequency control. Original cost over $20.00. Weight 4 lbs. Have been in sets, but guaranteed to be a good value. Stock No. GI-13FS, General Instrument TV tuner, less tubes. Net price $2.95 each.

2-TUBE SARKES-TARZIAN TUNER LESS TUBES $7.95

Sarkes-Tarzian new two tube model, type TT-3A, 12 channel television tuner. This is the new 2 tube model requiring a 6J6 plus 6AK5, or 6AG5, or 6CB6 or 6AU6 RF tube. Pre-aligned by trained factory personnel. Input feeds 21 mc broad band. Fine tuning control is over the channel selector shaft. Power requirements 120 to 140 volts DC at 17 mills, plus 6.3 volts filament. This tuner is offered at a terrific saving to you. Stock No. TT-3A. Net price $7.95, two for $13.95, less tubes. Available with 2¼", 2⅝" or 7⅛" shaft. Specify shaft length desired. 6J6 and 6AU6 tubes for above tuner, both for $2.39 extra.



T.V. FRINGE AREA DEALERS—ATTENTION
FM AND TELEVISION BOOSTER SALE

ANOTHER McGEE SCOOP
WHY PAY MORE?
NOT A KIT BUT A FACTORY-BUILT BOOSTER

$10.95



Sensational value. Continuously variable inductance type tuner, from channel 2, including the FM band, through channel 13. This booster is self powered for 110 volts AC operation. Incorporates a 6J6 tube. Input for 300 ohm TV line and 300 ohm output for the TV set. Single knob tuning. Attractive plastic case. McMurdo-Silver Super Senior TV-FM booster. Stock No. GB-6B. Shipping weight 5 lbs. McGee's terrific sale price, $10.95 each, two for $20.00.

COMPLETE 17" TO 20" T.V. KIT

★ AC-TRANS-TYPE
★ CONVENTIONAL CIRCUIT
★ READY WIRED 12 CHANNEL T.V. FRONT END
★ 70° DEFLECTION ★ CERAMIC FLYBACK
★ KIT OF TUBES EXCEPT KINE $16.95 ★ 17BP4A $21.95 EXTRA

$59.95 LESS TUBES



A complete kit of parts to build an AC transformer operated television chassis for use with a 16, 17 or 20 inch rectangular picture tube. The 12 channel Sarkes Tarzian tuner is ready wired. The 6 tube video IF strip is also wired. Circuit is of the conventional accepted design, with latest ceramic type flyback high voltage supply. Chassis is ready punched. Warning: Do not buy this kit unless you understand Television and electronics. It is difficult to wire. We furnish schematic and photos. Kit model WK 20 ship weight 40 lbs. less all tubes $59.95. Kit of 10 tubes but less picture tube $16.95 extra. 17 inch 17BP4A $21.95 extra. 20CP4 inch rect. tube $39.95 extra.

CONVERT YOUR T.V. TO A LARGER PICTURE TUBE



LOOK—16" RECTANGULAR CONVERSION KIT

$28.95

With each conversion kit you get a plastic mask, 70 degree deflection yoke, 90 day guaranteed black face picture tube, plus our new 7741-X 14,000 Volt Universal Tv-dapt and horizontal output transformer that works on any output tube and any single rectifier (1B3 or 1S2). A suggested diagram is furnished for use of this transformer with several different tube types and rectifiers. We think this is the finest and best priced conversion kit on the market. Transformer is in stock for immediate delivery.

Kit No. TCK-14,	with 14BP4A	14"	rectangular tube. Net price $27.95
Kit No. TCK-16,	with 16BP4A	16"	rectangular tube. Net price 28.95
Kit No. TCK-17,	with 17BP4A	17"	rectangular tube. Net price 29.95
Kit No. TCK-20,	with 20CP4A	20"	rectangular tube. Net price 49.95

REGENCY T.V. BOOSTER $19.10



McGee has the famous Regency DB-410 TV booster. Order yours from McGee. Shipping weight 6 lbs. Sale price, $19.10 each.

Video Coil Kit $7.95

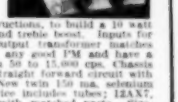


20 matched TV video and sound IF coils. Intended for use with the RCA circuit. You get 6 peaking coils, 4—2.5 mc. for picture I.F.'s, 2—21.25 mc sound I.F.'s, 1 discriminator and converter coil and 5 filament chokes. Stock No. 20-IFC, weight 2 lbs. Net price $7.95. $6.95 if purchased with ANY TV tuner; all coils identified.

SENSATIONAL NEW 2-BAND RADIO KIT ONLY $14.95

10-WATT HIGH FIDELITY AMPLIFIER KIT $14.95

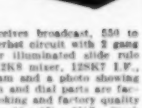
★ MIKE INPUT ★ PHONO INPUT
★ BASE AND TREBLE BOOSTER



A complete kit of parts, including tubes, diagram and instructions, to build a 10 watt high fidelity twin tone control audio amplifier, with bass and treble boost. Inputs for radio tuner, crystal mike and crystal phono pickup. Output transformer matches 4 & 25o ohms. Use with our 12" coaxial FM speaker, or any good FM and have a beautiful sounding, low cost amplifier. Heavy gauge formed steel chassis is ready punched and a ventilated cover is furnished. A straight forward circuit with twin triode cath stages and 2-50L6 tubes in push pull. New twin 150 ma. selenium rectifier voltage doubler type power supply. Tubes required, 12AX7, 12AU7 and 2-50L6, plus rectifiers. A good quality kit with matched parts. Size, 5¾"x10"x5⅝" high, including cover. Stock No. AP-10K, shipping weight 8 lbs. Sale price $14.95 each. 12" coaxial FM speaker, $12.95, extra.

MODEL ME6-2 $14.95

NEW MODEL 6-TUBE, 2-BAND RADIO KIT
A FULL 2-GANG SUPERHET KIT
RECEIVES 550-1600 KC PLUS 6-18 M.C.



McGee's new 1951, 6 tube; AC-DC 2 band radio kit. Receives broadcast, 550 to 1600 kc and short wave, 6 to 18 mc. A straight forward superhet circuit with 2 gang tuning condenser, 456 kc I.F. transformers, etc. 5" speaker illuminated slide rule dial. Everything furnished, including tubes, 12SK7, R.F., 12K8 mixer, 12SK7 I.F., 12SQ7 detector, 1st audio, 35L6 output, 35Z5 rectifier, diagram and a photo showing view of underside of completely wired chassis. The chassis pan and dial parts are factory production. With this kit, you can build a commercial looking and factory quality 2 band radio, housed in a streamlined plastic cabinet. Size: 15 x 6⅝ x 6¼". Stock No. ME6-2, shipping weight 10 lbs. Net $14.95.

SELF POWERED AC Broadcast Tuner Kit, 3-Gang Tuning. Complete Kit, $12.95



A self-powered, 3-gang superhet tuner kit with R.F. stage. When wired according to our diagram will make a top quality broadcast tuner (550 to 1650 kc) for use with any amplifier. Don't class this with ordinary tuners, this has its own power transformer. This complete kit is furnished with a diagram, photos and tubes, 6AU6 R.F., 6BE6 oscillator R.F., 6AU6 I.F. detector, AVC, 6AV6 audio output to any audio amplifier. Ideal for use with our 5-20-20, TM-16 or TX5 amplifier kits. Chassis size, 9¼x5¼x 4½" high. Shipping weight, 7 lbs. Broadcast tuner kit Model BT-38X. Net price, $12.95.

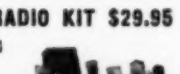
5-TUBE 22 WATT Wide Range Amp. Model Tx5 Kit Only $37.95



A complete kit, including tubes (3-7E5, 2-7F7, 2-6A3, plus rectifier), diagram and photos. All triode circuit makes for minimum harmonic distortion. Inputs for radio tuner any kind of phono pickup, crystal or G.E. variable reluctance and either crystal or dynamic mike. Output transformer matches 8 ohm voice coil. Has electronic tone controls, bass and treble with range selector switch for either juke box or brilliant symphonic range. Response is flat response or brilliant symphonic range. The best quality amplifier kit we know how to make. Has a very wide range output and heavy power transformer. Response 10 to 20,000 CPS. 6 tube all triode amplifier kit, complete with tubes. Weight 25 lbs. Net $37.95.

10-TUBE RADIO KIT $29.95

3-GANG TUNING
MIKE INPUT
12 WATT
HI-FI AUDIO
BASS-TREBLE BOOST



A NEW 1951 ALL-PURPOSE RADIO KIT

10-Tube Broadcast (550 to 1700 kc Radio Kit for custom builders. Features 3-gang superhet circuit with A.V.C., high gain IF circuit, 8" slide rule dial. Chassis size 12½" long, 10" front to back, 6¼" high. Audio inputs for a crystal or dynamic mike, record changer or player. Tone compensation for standard crystal pick-up or General Electric variable reluctance. Push-pull 6V6 output tubes, shielded high fidelity output transformer matches 8 ohm PM speaker, husky power transformer, 2 tone controls for separate bass and treble boost. A complete kit, including tubes 6SK7 R.F., 6SK7 mixer, 6SK7 I.F., 6H6 detector, AVC, 6SQ7 1st audio, 12AX7 variable reluctance and mike amplifier, 12AX7 phase inverter, 2-6V6 outputs, plus rectifier, diagram and instructions. Shipping weight 18 lbs. Stock No. HK-R10. Net price $29.95. 10" PM speaker, $6.95 extra. Crystal mike and desk stand, $4.95 extra. 12" coaxial speaker $12.95 extra.

5-Tube Broadcast SUPERHET RADIO KIT $12.95



Model RS-5 tube AC-DC superheterodyne radio kit. Has loop antenna and 2 gang condenser, with lighted slide rule dial and attractive plastic cabinet. Receives broadcast, 550 to 1650 kc. Full size dynamic speaker, matched 456 I.F.'s, automatic volume control. This is a complete radio kit. Everything furnished, including diagram, photos and tubes: 12K8 mixer, 12SK7 I.F., 12SQ7 detector, 1st audio, 50L6 output, 35Z5 rectifier. Shipping weight 7 lbs. Stock No. RS-5. Net price $12.95.

Build Your Own Phono-Mike Broadcaster $7.95



Kit Model BC-6R. With this simple kit, you can build a 3-tube phono oscillator that also has a mike input. Will broadcast over any radio, within your home, (about 75 feet from 1000 to 1500 kc. Inputs for crystal mike or crystal phono pickup. Fader control fades from mike to record. Ideal for a home P.A. system, baby sitter and entertainment. A complete kit of parts including tubes, Kit Model DE-6R. Net price, $7.95. DE-6RWT, wired and tested. Net price, $9.95. Crystal mike and desk stand, $4.95 extra. Concealed microphone unit, only 1" in diameter and ¼" thick, secretly hidden mike when ordering. Stock No. T-1601. Net $3.95 extra.

McGEE HAS EICO TEST EQUIPMENT KITS

Model 145-K, Multi-Signal tracer	Net	$19.95
Model 221-K Vacuum Tube Volt meter	Net	25.95
Model 315-K Signal Generator Kit	Net	16.95
Model 320-K Signal Generator	Net	19.95
Model 425-K 5" Oscilloscope Kit	Net	44.95
Model 625-K Tube Tester Kit	Net	34.95
Model 360-K Sweep Generator Kit	Net	34.95
Model 950-K Cond. Res. Comp. Bridge Kit	Net	19.95
Model 1040-K Battery Eliminator Kit	Net	28.95

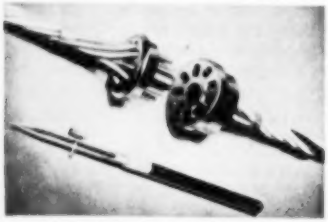
McGEE RADIO COMPANY
Prices F.O.B. K.C. Mo. Subject to change without notice. Orders Accepted Subject to Limitations Imposed by Priorities and Allocations. Orders Accepted Subject to Limitations Imposed by Priorities and Allocations. Send Money Order, Bank Draft, Cashier's Check or Certified Check. Include Postage. Write for Catalog. Open Account with Rated Firms. Orders Shipped Same Day Received. Shipments Made Via Best Means Unless Otherwise Specified. Orders Under $25.00 Must Include Sufficient Postage. Orders Over $25.00 Shipped Express Collect. Orders Under $25.00 Shipped Parcel Post Collect. Orders Under $25.00 Shipped Parcel Post Collect. Orders Under $25.00 Shipped Parcel Post Collect.
TELEPHONE VICTOR 9045. WRITE FOR FLYER
1422 GRAND AVE., KANSAS CITY, MISSOURI

WHAT'S *New in Radio*

For additional information on any of the items described herein, readers are asked to write direct to the manufacturer. By mentioning RADIO & TELEVISION NEWS, the page, and the issue number, delay will be avoided.

CABLE CONNECTOR

Alden Products Company, 117 North Main Street, Brockton 64, Massachusetts, has developed a new octal type 9-pin connector for use with TV color



adapters, u.h.f. converters, and other applications requiring a rugged, small connector.

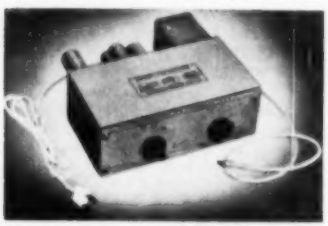
The connector (209FEC) and plug (109C) unit feature leads attached directly to the contact with no projecting solder terminals, 100 per-cent molded insulation around each contact and lead, individual strain relief for each lead, and the wire tip crimped firmly to eliminate the danger of cold solder joints.

PREAMP-EQUALIZERS

Brociner Electronics Laboratory, 1546 Second Avenue, New York 28, New York, is currently marketing two new preamplifier-equalizers, the Models A100 and the A100P.

Correct equalization is provided for all makes of microgroove records as well as for the older 78 rpm discs. Included are the original *Columbia* LP curve and the very different characteristic used by *RCA* for its LP's and 45's. The AES recommended playback curve is obtainable with one of the indicated dial settings.

Both units are supplied with brushed-brass designation plates for front panel mounting and both are



housed in chassis measuring 3" high and 8½" long at the panel and 7½" deep behind the panel.

The Model A100 has an adapter power plug to fit under the beam power output tubes while the A100P has an integral power supply.

A data sheet on these new units is available from the company on request.

COAXIAL SPEAKER

Oxford Electric Corporation, 3911 South Michigan Avenue, Chicago 15, Illinois, has added another speaker to its line—a 12" coaxial unit.

The new speaker, the Model CO12JB, has been designed for quality AM, FM, and TV receivers as well as for monitoring, recording applications, and other sound installations.

Frequency range is 65 to 15,000 cps, the network crossover is at 4000 cycles, power rating is 10 to 12 watts, input impedance 8 ohms, while the woofer magnet measures 12" and weighs 6.3 ounces and the tweeter magnet is 3" and weighs 1.47 ounces.

WIDE-RANGE SPEAKER

University Loudspeakers, Inc., has added a new 12" wide-range, wide-dispersion cone speaker to its line.

The "Diffusicone-12" features a dual



concentric apex horn which both extends the high frequency response to over 13,000 cps and disperses these normally beam-like frequencies uniformly throughout the listening area. The "diffusor" element used provides dual horn loading of the speaker apex, substantially increasing high frequency efficiency, and combines both radial projection and aperture diffusion of the high frequencies to assure reception of the speaker's complete range of reproduction.

Of special interest to the service technician and custom installer is the company's exclusive "bi-sectional" construction of this unit which enables replacement of either the entire basket/diaphragm assembly or the magnet mechanism in the field without special tools.

A specially prepared catalogue sheet, together with complete cabinet prints, is available by writing direct to the company at 80 S. Kensico Avenue, White Plains, N. Y.

NEW "LOOPSTICK"

Grayburne Corporation of 103 Lafayette Street, New York 13, New York has come out with a companion unit to its "Ferri-Loopstick"—the "Vari-Loopstick."

The new unit retains all of the features of the "Ferri-Loopstick" but has,



in addition, micrometer adjustment. This new feature has been incorporated for the benefit of technicians and hobbyists who are "station jumpers" and "DX hounds" and for those who want to peak-resonate for a series of stations at will.

Both the new and the older unit can be used to replace older type loop antennas in any broadcast receiver.

FOLDED HORN BLUEPRINTS

Jensen Manufacturing Company, 6601 S. Laramie Avenue, Chicago 37, Illinois, is offering without charge blueprints and instructions for building the new backloading folded horn which was recently demonstrated in conjunction with the company's G-610 "triaxial" speaker at the Audio Fair in New York.

This 30 cubic foot enclosure, developed by D. J. Plach and P. B. Williams, is of particular interest to professional sound men and high fidelity enthusiasts because of its moderate cost.

Compactly arranged in a cabinet 5 x 3 x 2 feet, the new horn design reduces the loudspeaker resonant frequency by almost one octave, increases efficiency 4 to 6 db over the entire piston range, improves transient performance, and allows doubling the loudspeaker power rating for a given amount of distortion.

For details on how to secure the building plans for the cabinet write the company direct.

PICKUP CARTRIDGES

The Astatic Corporation of Conneaut, Ohio, has developed a new turnover pickup cartridge which is said to



provide performance quality equal to that obtainable from single-needle units.

The cartridge uses two complete

(*Continued on page* 120)



EDW. H. GUILFORD
Vice President

I can train you to pass your FCC License Exams in a minimum of time if you've had any practical radio experience—amateur, Army, Navy, radio servicing, or other. My time-proved plan can help put you, too, on the road to success.

Let me send you FREE the entire story

Just fill out the coupon and mail it. I will send you, free of charge, a copy of "How to Pass FCC License Exams," plus a sample FCC-type Exam, and the amazing new booklet, "Money-Making FCC License Information."

How to Pass FCC License Exams

Commercial Radio Operator



FREE

Tells where to apply and take FCC examinations, location of examining offices, scope of knowledge required, approved way to prepare for FCC examinations, positive method of checking your knowledge before taking the examination.

Get Your FCC Ticket in a Minimum of Time

Get this Amazing Booklet FREE



TELLS HOW YOU CAN GET A FREE TELEVISION ENGINEERING COURSE

TELLS HOW—

WE GUARANTEE

TO TRAIN AND COACH YOU AT HOME IN SPARE TIME UNTIL YOU GET

YOUR FCC LICENSE

If you have had any practical experience—Amateur, Army, Navy, radio repair, or experimenting

TELLS HOW—

Employers make JOB OFFERS Like These to Our Graduates Every Month

Letter, October 11, 1951, from Chief Engineer, Broadcast Station, North Carolina. "Need men with radiotelephone 1st class licenses; no experience necessary. Will learn more than at average station for we are equipped with Diesel Electric power, transmitting and studio equipment."

Telegram, October 2, 1951, from Chief Engineer, Broadcast Station, Wyoming. "Please send latest list available first class operators. Have November 10th opening for two combo men."

These are just a few examples of the job offers that come to our office periodically. Some licensed radiomen filled each of these jobs . . . it might have been you!

HERE'S PROOF FCC LICENSES ARE OFTEN SECURED IN A FEW HOURS OF STUDY WITH OUR COACHING AT HOME IN SPARE TIME

Name and Address	License	Lessons
Lee Worthy 2210½ Wilshire St., Bakersfield, Cal.	2nd Phone	15
Clifford E. Vogt Box 1016, Dania, Fla.	1st Phone	30
Francis X. Fourch 38 Decatur Pl., Bergenfield, N. J.	1st Phone	38
S/Sgt. Ben H. Davis 317 North Roosevelt, Lebanon, Ill.	1st Phone	28
Albert Schnell 110 West 11th St., Escondido, Cal.	2nd Phone	23

CLEVELAND INSTITUTE OF RADIO ELECTRONICS
Desk RN-39—4900 Euclid Bldg., Cleveland 3, Ohio

TELLS HOW—

Our Amazingly Effective JOB-FINDING SERVICE Helps CIRE Students Get Better Jobs

Here are a few recent examples of Job-Finding results

GETS FIVE JOB-OFFERS FROM BROADCAST STATIONS

"Your 'Chief Engineer's Bulletin' is a grand way of obtaining employment for your graduates who have obtained their 1st class license. Since my name has been on the list I have received calls or letters from five stations in the southern states, and am now employed as Transmitting Engineer at WBMT."
Elmer Powell, Box 274, Sparta, Tenn.

GETS CIVIL SERVICE JOB

"I have obtained a position at Wright-Patterson Air Force Base, Dayton, Ohio, as Junior Electronic Equipment Repairman. The Employment Application you prepared for me had a lot to do with my landing this desirable position."
Charles E. Loomis, 4516 Genesee Ave., Dayton 6, Ohio.

OURS IS THE ONLY HOME STUDY COURSE WHICH SUPPLIES FCC-TYPE EXAMINATIONS WITH ALL LESSONS AND FINAL TESTS.

GETS JOB WITH CAA

"I have had half a dozen or so offers since I mailed some fifty of the two hundred employment applications your school forwarded me. I accepted a position with the Civil Aeronautics Administration as Maintenance Technician. Thank you very much for the fine cooperation and help your organization has given me in finding a job in the radio field."
Dale E. Young, 122 Robbins St., Owosso, Mich.

Your FCC Ticket is recognized in all radio fields as proof of your technical ability.



Get All 3 FREE

MAIL COUPON NOW

CLEVELAND INSTITUTE OF RADIO ELECTRONICS
Desk RN-39, 4900 Euclid Bldg., Cleveland 3, Ohio
(Address to Desk No. to avoid delay)

I want to know how I can get my FCC ticket in a minimum of time. Send me your FREE booklet, "How to Pass FCC License Examinations" (does not cover exams for Amateur License), as well as a sample FCC type exam and the amazing new booklet, "Money-Making FCC License Information."

☐ Tell me how I can get your Free Television Course.

NAME .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

Paste on penny post card or send air mail

Special Purchase FM Radio Chassis



Complete with 5 tubes. Built-in Antenna and Speaker. Product of Famous Radio & TV Manufacturer whose name we are prohibited not to mention.

TUBE LINEUP

1—12BA7 1—12S0
2—12BA6 1—35W4
1—35B5

Regularly $29.95
Brand New

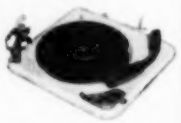
$16.95

Max also be used as an FM Tuner by picking signal off detector

SPECIAL PURCHASE!

GENERAL INSTRUMENTS 3-SPEED AUTOMATIC RECORD CHANGER

REGULARLY $34.95
BRAND NEW



$19.97

With all-purpose cartridge and needle. Plays 33⅓, 45, and 78 RPM records automatically.

NOTE: Do not send money for postage on above items. we ship best way—charges collect.

LOW FREQ. XTALS-FT 241A
For 550 kc/sec filter etc. ½" sqr. 540 or 72nd harmonic channels listed for fundamentals. Fractions omitted.

372	404	436	468	400	462	5910	7440
374	405	437	507	440	463	6370	7045
375	407	438	508	441	464	6450	7105
377	408	481	509	442	466	6470	7125
379	409	503	511	444	468	6497	7145
380	411	504	512	446	469	6522	7155
381	412	505	514	447	470	6547	7220
383	413	507	515	448	472	6610	7254
384	414	508	516	450	474	7350	7280
385	415	490	518	451	475	7400	7292
386	416	491	519	452	476	7500	7290
387	418	492	520	455	477	7810	7300
388	419	493	522	457	479	7930	7305
390	420	494	525	459	480		7320
391	422	495	526	461			7360
392	423	496	530				7390
393	424	497	531				7415
394	425	498	533				7435
395	426	503	537				
398	427	504	538				
397	429						
398	431						
401	433						
402	434						
403	435						

SCR 522 Xtals
¼" pins ½" spc.

99c ea. 10 for $9.00

$1.29 each

BC-610 Xtals
2 banana plugs ¾" spc.

2035	2440	2845	3250
2045	2532	2850	3255
2105	2540	2855	3260
2125	2557	2860	3265
2145	3202	2865	3270
2155	3215	2870	3275
2220	3232	2880	3280
2254	3250	2885	3285
2280	3322	2890	3290
2292	3540	2895	3295
2290	3520	2900	3300
2300	3550	2905	3305
2305	3570	2910	3310
2320	3540	2915	3315
2360	3945	2920	3320
2390	3955	2925	3325
2415	3965	2930	3330
2435		2935	3335

SPECIAL
200 Kc stals without holders
99c Each
3 for $2.00

$1.29 each

HAM XTALS-FT 243 HOLDERS—½" pin spc.

4190	6771	7840	1015	5773	6273	6540	7440
5030	6873	7875	1179	5805	6306	6573	7473
5465	6906	7906	2045	5886	6325	6575	7506
6040	6973	7940	3735	5925	6340	6600	7540
6070	7140	7973	3805	5940	6373	6606	7573
6105	7773	8273	5677	5950	6406	6625	7606
6125	7806	8306	5708	5973	6440	6640	7640
6140			5725	5975	6456	6673	
6173			5740	5906	6473	6706	
6175			5750	5940	6475	6740	
6206			5760	5973	6506	7340	

40c Ea. 10 for $4.00

95c Ea. 10 for $9.00

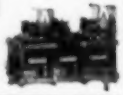
Add 20c for each 10 stals or less for postage and handling.

VARIABLE CONDENSERS

From BCR-522 2 Gang—25 MMF per section **$1.29**



From BCR-522 3 Gang—25 MMF per section **$1.59**



BRAND NEW with CONCENTRIC AIR TRIMMERS

TERMS: All items F. O. B., Washington, D. C. All orders $30.00 or less, cash with order. „Above $30.00, 25 per cent with order, balance C. O. D. Foreign orders cash with orders, plus exchange rate.

SUN RADIO
OF WASHINGTON, D. C.
938 F STREET N W WASH 4 D C

Spot Radio News

(*Continued from page 18*)

Electronics Production Board, and Lieutenant Colonel Carl B. Lindstrand of the Electronics Production Resources Agency, in the Department of Defense, during a visit to the facilities of twelve companies in Western Germany and Milan, Italy.

The purpose of the trip, it was revealed, was to survey possible sources for electronic parts in Europe to determine the availability of certain items, considered to be critically short here. The investigation indicated that generally .05 to 3 watt resistors were in common production, while some companies produced sizes up to 50 watt capacity. Production in this country has been limited to .5-2 watt types. It was pointed out that the small-size resistors, between .05 and .25 watt, could be considered by the military for their gear. Facilities for precision wirewound resistors were also located, although the outputs were small. Fine enameled-resistance wire, as small as .0012 inch, was also found to be available. Two plants were found to be capable of producing selenium rectifiers, using selenium imported from Sweden. One manufacturer said that he was making a rod-type rectifier with ratings from 20 volts at 5 milliamperes to 5000 volts at 3 milliamperes. Also being processed are the conventional disc-type assemblies.

Reviewing the facilities and equipment employed at these foreign sources, a detailed report indicated that one organization was producing deposited carbon resisitors using automatic spiraling machines featuring a magazine feed and having a spiraling capacity of from 600 to 3500 resistors an hour, depending on the values. In addition, lead wires could be automatically attached by a machine having a capacity of 2000 resistors an hour.

The trip to the plant of the selenium disc manufacturer revealed that the company is currently producing 100,000 square inches of processed selenium rectifier plates a day. Because of the scarcity of selenium it is expected that this rate will be reduced by fifty per-cent. However, it was said, production could be increased to 160,000 square inches within six months, if material became available. When the report was prepared, late last year, it was noted that up to 50,000 discs (125 ma. or equivalent) could be delivered in approximately six to eight weeks. The cells produced in this plant were described as being of the nickel-plate iron plate type, with a layer of selenium. For passing current, an opposite electrode, composed of a special alloy, was said to be provided. This method of making contact was cited by the manufacturer as being superior to the pressure technique, assuring reliable contacts. The rectifiers were said to be usable in all of the popular applications such as for the charging and floating of batteries, d.c. supply in a.c.-d.c. chassis, excitation of electromagnets, etc.

The rod-type rectifiers were noted as being unique in their structure, an entirely new design making it possible to reduce the length of the element in tube form to less than that of any rod unit made. It was said that a peak inverse voltage of 930/cm., or 2350 volts-per-inch, had been attained. The construction of the elements in tubes made of an insulating material was cited as insurance against discharge and flashover at very high voltages. The rectifiers were said to be usable as a d.c. supply for condenser testing; d.c. supply for TV units; and d.c. supply for all types of high-voltage testing gear.

The complete report, including all this extremely valuable data, is available for inspection in either room 2314, Temporary *T* building, 14th and Constitution, N.W., or room 4H4, GAO Building, 443 G Street, N.W., Washington, D. C.

TWO NEW SHIP-TO-SHORE channels may become the official frequencies of the maritime radiotelephone service, if the proposals offered by the Commission are accepted by rail and ship operators: 162 megacycles (coast) paired with 157.3 megacycles (ship) and 161.9 megacycles (coast) paired with 157.4 megacycles (ship.).

It is hoped that these standardized frequencies will be adopted since it is felt that they will serve to simplify not only the operational problems confronting those in the Great Lakes area, but the equipment used on the lakes and connecting waterways.

The Commission has also suggested that the 157.1 megacycle channel be assigned to the government, so that ship-to-shore operators might have two adjacent channels: 157.3 (which now is a government channel) and 157.4. In the event the maritime mobile service finds in the future that it can utilize 50 kilocycle channel separation, in lieu of the present 100 kilocycle separation, the way is left open whereby an additional *public correspondence* pair or two additional *operational* frequencies can be utilized.

THE GEOGRAPHICAL, GEOLOGICAL and geophysical radiolocation services, which during the past five years have soared in importance, particularly in the southwest, have won a new band: 1750 to 1800 kilocycles.

Analyzing the reasons for the assignment of the new frequency, the Commission said that experience has indicated that, except for petroleum exploration operations in the Continental Shelf area, line-of-sight ranging would not fall short. The maximum dependable surveying range of an ultra-high frequency system limits the direct operational range of the practical exploration system to an off-shore distance on the order of 15 to 25 miles. On the other hand, there appear to be areas in the Shelf area considered commercially exploitable for oil at dis-

BUY TEST EQUIPMENT
ON THIS RADICALLY NEW
TIME PAYMENT PLAN
NO INTEREST!! - NO CARRYING CHARGES!!
USE CONVENIENT TIME PAYMENT ORDER BLANK BELOW

Superior's New
JUNIOR SUPER-METER



MOST COMPLETE AND COMPACT MULTI-SERVICE INSTRUMENT EVER DESIGNED

Measures: * Voltage * Decibels * Capacity * Resistance * Current * Inductance * Reactance

Specifications: D.C. Volts: 0-7.5/75/150/750/1500 Volts. A.C. Volts: 0-15/150/300/1500/3000 Volts. Resistance: 0-10,000/100,000 ohms. 0-10 Megohms. D.C. Current: 0-7.5/75 Ma. 0-7.5 amps. Capacity: .001 Mfd.—.2 Mfd. .1 Mfd.—20 Mfd. Electrolytic Leakage: Reads quality of electrolytics at 150 Volt test potential. Decibels: —10 Db to +18 Db. + 10 Db. to + 38 Db. + 38 Db. to + 58 Db. Reactance: 15 ohms—25 K ohms 15 K ohms—2.5 Megohms. Inductance: .5 Henry—50 Henries 30 Henries—10 K Henries. Plus Good-Bad scale for checking the quality of electrolytic condensers.

Handsome round cornered molded bakelite case 3¾ x 5⅞ x 2¾" complete with all test leads and instructions ..... **$21.40 NET**

Superior's New Model TV-11
TUBE TESTER



• Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary. • Uses no combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket. • Free-moving built-in roll chart provides complete data for all tubes. • Phono jack on front panel for plugging in either phones or external amplifier detects microphonic tubes or noise due to faulty elements and loose external connections.

Operates on 105-130 Volt 60 Cycles A.C. Hand-rubbed oak cabinet complete with portable cover **$47.50 NET**

Superior's New Model CA-12
SIGNAL TRACER



The well known Model CA-12 is the only signal tracer in the low price range including both meter and speaker!!!

SPECIFICATIONS: • Comparative Intensity of the signal is read directly on the meter—quality of the signal is heard in the speaker. • Simple to Operate—only one connecting cable—no tuning controls. • Highly Sensitive—uses an improved vacuum-tube voltmeter circuit. • Tube and Resistor Capacity Network are built into the detector probe. • Built-In High Gain Amplifier—Alnico V Speaker.

Completely Portable—weighs 8 pounds—measures 5¼" x 6½" x 9".

Model CA-12 comes complete with all leads and operating instructions ..... **$33.95 NET**

Superior's New
TV BAR GENERATOR



Throws an Actual Bar Pattern on Any TV Receiver Screen!!

Two Simple Steps:

1. Connect Bar Generator to Antenna Post of any TV Receiver.
2. Plug Line Cord into A.C. Outlet and Throw Switch.

RESULT: A stable never-shifting vertical or horizontal pattern projected on the screen of the TV receiver under test.

Power Supply: 105-125 Volt 60 Cycles. Power Consumption: 20 Watts. Channels: 2-3 on panel, 7-13 by harmonics. Horizontal lines: 4 to 12 (Variable). Vertical lines: 12 (Fixed). Vertical sweep output: 60 cycles. Horizontal sweep output: 15,750 Cycles.

TV Bar Generator comes complete with shielded leads and detailed operating instructions. Only ..... NET $39.95

Superior's New Model 660—AN AC OPERATED
SIGNAL GENERATOR

Provides Complete Coverage for A.M.-F.M. and TV Alignment

• Generates Radio Frequencies from 100 kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 240 Megacycles on powerful harmonics. • Accuracy and stability assured by use of permeability trimmed Hi-Q coils. • R.F. available or modulated by the internal audio oscillator. • Built in 400 Cycle sine wave audio oscillator used to modulate the R.F. signal also available separately for audio testing of receivers, amplifiers, etc. • Oscillator Circuit: Uses a miniature high frequency type of screen triode in a Hartley circuit to insure a high degree of stability. By using the same type of triode as a buffer amplifier, complete and positive isolation between the R.F. oscillator and the attenuator is attained. • Attenuator: a 3 step ladder type of attenuator is used. Each step of the attenuator is controlled by a separate attenuator control thus providing intermediate level steps. • Tubes used: 955, as R.F. Oscillator, 955 as Modulated Buffer Amplifier, 6SN7 as Audio Oscillator and Power Rectifier.



The Model 660 comes complete with coaxial cable test lead and instructions ..... NET **$42.95**

NEW TIME PAYMENT PLAN
ORDER BLANK

MOSS ELECTRONIC DISTRIBUTING CO., INC. B-19
Dept. B-19, 38 Murray Street, New York 7, N. Y.

Please send me the units checked below. I am enclosing the down payment with order and agree to pay the monthly balance as shown. It is understood there will be no carrying, interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

☐ **JUNIOR SUPER METER** ..... Total Price $21.40
$5.40 down payment. Balance $4.00 monthly for 4 months.

☐ **MODEL TV-11** ..... Total Price $47.50
$11.50 down payment. Balance $6.00 monthly for 6 months.

☐ **MODEL CA-12** ..... Total Price $33.95
$9.95 down payment. Balance $4.00 monthly for 6 months.

☐ **TELEVISION BAR GENERATOR** ..... Total Price $39.95
$9.95 down payment. Balance $5.00 monthly for 6 months.

☐ **MODEL 660** ..... Total Price $42.95
$12.95 down payment. Balance $5.00 monthly for 6 months.

☐ I enclose $ ..... as down payment.

☐ Ship C.O.D. for the down payment.

Signature .....

Name .....

Address .....

City ..... Zone ..... State .....

All Channel Reception

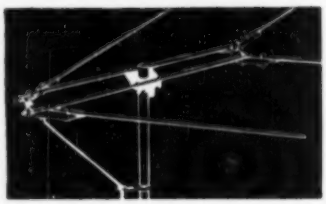


With Extra Performance

WHERE YOU NEED IT

WITH **DUBL·VEE**

BY **WORKSHOP**



In the high bands . . . it's the original patented Dubl-Vee specially designed by WORKSHOP engineers to "bring-in" extra signal on channels 7 thru 13, while retaining excellent reception on channels 2 thru 6.

Gains up to 8 db for single bays and 10 db for double bays assure maximum signal. Rugged, streamlined construction cuts wind resistance. Only the Dubl-Vee gives these performance extras . . . tops for signal and tops for strength.

On your next installation, install the WORKSHOP Dubl-Vee . . . the original Dubl-Vee designed and patented by WORKSHOP . . . at radio parts distributors everywhere.



THE WORKSHOP ASSOCIATES

Division of the Gabriel Co.

135 Crescent Road

Needham Heights 94, Mass.

tances of 40 to 70 miles from the Gulf of Mexico coastline. The use of the customary survey procedures to carry the survey stepwise in the water to offshore distances much greater than 15 to 25 miles appears to be neither reliable nor economically practical. Accordingly, the Commission felt that there was a definite need for a radiolocation service which is not subject to the line-of-sight limitations of the frequencies on the higher bands, as an aid in the development of the oil resources lying beneath the waters of the Gulf of Mexico.

A normal maximum bandwidth was also prescribed in the new ruling: 3 kilocycles. No definite prohibition was imposed against exceeding this bandwidth because it appears as if the question of *lane identification* or means of obtaining spot positioning has not as yet been satisfactorily resolved. During the hearings there were described phase-comparison methods which permit the use of low or medium frequencies and the elimination of the line-of-sight limitation as a radiolocation technique. However, *with this method*, within the limits of the space available, it has not been possible to develop an adequate system of *lane* identification, and thus mobile craft must enter the hyperbolic grid system at a known point, and thereafter maintain continuous operation throughout the duration of the survey. This lack of an adequate method of spot positioning has been found to be one of the chief stumbling blocks to the development of an all-purpose radiolocation system. Present methods involve the use of either additional 3 kilocycle channels or the use of a wider bandwidth. Accordingly, the Commission noted that a bandwidth greater than 3 kilocycles will normally not be authorized, except where additional space is needed for *lane identification* purposes.

Since there does not appear to be any single radiolocation system which has been found to be satisfactory in all respects, all stations licensed under the new regulations will be on a developmental basis only.

DURING WORLD WAR II, radio proved itself to be a dynamic aid in psychological warfare. Since then, broadcasting has played a roaring role in this direction in a multi-million dollar campaign, here and overseas, through the facilities of the Voice of America and stations in occupied zones in Europe.

To provide flexibility to the program and permit the transmission of psychological warfare messages into enemy territory, there has been produced a complete mobile broadcast system which can be carried by truck and trailer on land, by cargo planes aloft, and by ships at sea. Housed in a pair of 26-foot trailers and three eleven-foot shelters designed by the Army Signal Corps Engineering Labs at Fort Monmouth and the Department of the Army, the station is as complete as a modern fixed station. The broadcast

DOW SURPLUS

TELECHRON SYNCHRONOUS MOTOR
Type C2M 115V–60 cycle Model 822 N. 1915 —RPM 6—Removed from new Surplus $4.95

MISCELLANEOUS ITEMS

Rubber Grommets—100 asst.	$0.99
BC 457—Amplifiers 4 to 8. 3 mc new	9.95
BC 401 control box with counter	1.49 ea.
T-24C mike and plug	.99 ea.
Hook-up Wire approx. 400 ft. 2 to 4 ft. lengths and longer	.98
APC condensers, all sizes	.49 ea.
1250 ft. □WL130 twisted Telephone wire	4.50
50 Watt—Tube Sockets—new	.49
Antenna Insulators—10 for	.99
3 Asst. 24V Relays	1.00
FILAMENT TRANSFORMERS—110V–60 cycle input, output 9V to 13V in 1V steps—output rated 3 amps	1.89
G.E. Solenoids—14V DC—25 ohms—Mycalex arm, many applications—new	.49

GP7 TUNING UNITS, A TO F, for ECO, $3.95 ea.

PANEL METERS
NEW SURPLUS
STANDARD BRANDS
★ SPECIAL SCALE
SQ—SQUARE CASE

3" METERS

0-8V AC	$3.95
0-150V AC	3.95
0-150V AC	3.95
0-15V AC	3.95
0-15 MV DC	3.95
0-2V DC	3.95
0-1 Mill DC SQ*	4.95
500-0-500 DC Mill.	4.95
0-600 Mill DC SQ	4.95

2" METERS

0-1 RF Amp	$5.95
0-8 RF Amp	5.95
0-3 DC Mill	3.95

RHEOSTATS

Watts	Resistance	ea.
25	1 ohm	$0.98
25	8	98
25	15	98
25	50	98
25	75	98
25	100	98
25	150	98
25	370	98
25	500	98
25	2000	98
25	5000	98
100	4	2.50
100	100	2.50
150	5000	3.95

RF CHOKES

2½ MH—100 mill	29¢
2½ MH—500 mill	59¢
2½ MH—1000 mill	99¢

TUBES

SURPLUS	Ballast $0.19 ea.
13-4	4/ 1.35
80LA $0.39	4/ 1.35
843	4/ 1.35
1625	4/ 1.35
1626	4/ 1.35
1629	4/ 1.35
HY615	4/ 1.35
RK73	4/ 3.00
958A	4/ 3.00
6BR7GT	4/ 3.00
6SJ7	4/ 3.00
6AL5	4/ 3.00
1L6G	4/ 3.00
41	4/ 3.00
RK873	4/ 3.00
6AK5	4/ 4.00
2051	4/ 5.00
837	4/ 5.00

BARGAIN	
1S5	4/ $3.00
6Q7	1.95
1N5GT	4/ 6.00
5Y3GT	4/ 6.00
1616	4/ 6.00
9001Z	2.75
RK30	2.75
6J3	4.95
860	4.90
2J21A	4.95
9BP1	4.95
9001L	4.95
3BP1	6.95
250R	9.95
804	10.95
4E27 357	14.50
861	15.95
860	19.95

OIL CONDENSERS

10 mfd 600V	$3.95
2 mfd 600V Round	.69
2X1 mfd 600V Round	.99
1 mfd 6000V	4.95
2 mfd 4000V — oil 6823F47 Pryn-	6.95
90 mfd 120V AC 6823G69 Pryn-	7.95

SPRAGUE ☐4884
Four 8 mfd Sections in One Can. 600V—oil-filled. perfect for amplifiers $4.95

NEON INDICATORS

NE 2	10c ea.
NE 68	20c ea.
NE 30	37c ea.

VARIABLE CONDENSERS

Dual-100 mmfd	$1.49
Dual 20 mmfd per Section. Miniature	1.49
1 Gang 365 per Section	.98
4 Gang 150 per Section	.98
9 Gang 365 per Section	1.95

FUSES 30 amp plug fuse, house type . . . 10 for 30c

Amp.	Type	Each	10 for	100 for
½	8AG	$0.01	$0.25	$2.00
¾	8AG	03	.25	2.00
1	3AG	03	.25	2.00
1 3/16	3AG	03	.25	2.00
1½	3AG	03	.25	2.00
2	3AG	03	.25	2.00
3	3AG	03	.25	2.00
4	3AG	03	.25	2.00
10	3AG	03	.25	2.00
15	3AG	03	.25	2.00
20	3AG	03	.25	2.00
1	4AG	05	.40	2.95
4	4AG	05	.40	2.95
10	4AG	05	.40	2.95
15	4AG	05	.40	2.95
25	4AG	05	.40	2.95
30	4AG	05	.40	2.95
40	4AG	05	.40	2.95
70	ACL		.40	2.95
20	5AG	05	.40	2.95
30	5AG	05	.40	2.95
50	5AG	05	.40	2.95
70	5AG	05	.40	2.95

KEYS

J-5A	$0.95
J-32	1.25
J-38	1.25
J-41A	.89
J-47	1.25
J-48	1.25

EDWARDS BUZZERS
#1692—115 V—60 cycle .05 amp. ..... $.49
.115—size O—12V DC works on 6V less coverage. Fine for Code Practice Sets ..... .69

Open Circuit Jacks. Standard	10 for $1.50
JK 26 and PL 54	per set .49
3 AG fuse post	.25
4 AG fuse post	.29
3 AG type HJW	.38
30 Ft. hook-up wire	.10
Luminous Paint Kit. For Dusting, Painting or Mixing. Glows in the Dark	.79
6 Ft. AC line cords	ea. .15
Single Hole mtg. Push Button Switch	.19
TS11 Hand Sets	6.95
89A Toggle Sw.—SPDT—center off	2 1.00
Resistor Kit	100 .79
A62 Phantom Antenna—new	.79
35 FOOT STEEL ANTENNA MAST KIT. 7—Five foot sections—new	12.95

Write us for your meter wants. Over 3,000 in stock. Write for Our 16-Page Bulletin.

DOW RADIO, INC.

1759 E. Colorado St. Pasadena 4, Calif.

PHONE: SYcamore 3-1190

$1.50 min. order 25% deposit with orders

Send full remittance to save C.O.D. charges

All merchandise fully guaranteed. Subject to prior sale.

studio and control room are soundproof and air conditioned. Equipment includes the latest control consoles, magnetic tape recorder-reproducer units, turntables, and remote pickup units for on-the-spot broadcasts away from the studio. The range of the station is said to be several hundred miles.

By the time this column appears in print, it is expected that the station will have been placed in operation by psychological warfare teams overseas.

WHEN THE PRESIDENT enters the remodeled White House, he will find that he will be able to tune in his favorite radio stations with a telephone-dial system. Sound will emanate from ceiling or wall units.

The President will also be able to listen to network programs not being broadcast locally, for they will be available through a telephone line system, directly tied into the facilities of the four network stations represented in Washington.

FM BROADCASTING has finally found itself approved by the BBC in Great Britain. After almost five years of exhaustive tests and surveys, it has been decided to set up a chain of FM stations operating in the 88 to 100 megacycle band. The final decision to accept this medium was due to a lack of standard broadcast bands, poor quality due to fading, increasing interference from foreign stations, and particularly the striking quality results achieved in difficult receiving areas. A report on these results, which appeared in the "*BBC Quarterly*," indicated that the sound quality was much better and there was generally less background noise, facts with which many hi-fi conscious listeners over here are quite familiar.

The introduction of the very-high frequencies and FM in England, featuring specially prepared BBC programs, will undoubtedly create a new family of high-fidelity enthusiasts whose reactions will probably be watched closely by the rabid wide-range fans over here. . . . L.W.

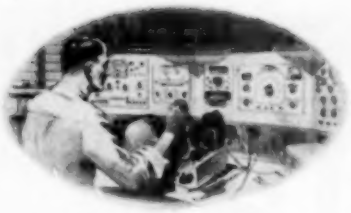
LEAD-IN CLEARANCE

FROM Guy F. Butts, 320 Lakewood Drive, Asheville, North Carolina comes a worthwhile service suggestion which we would like to pass on to technicians.

Mr. Butts warns that often lead-in clearance at the mast, near metal tension screens, metal casement windows, metal foundation ventilator grilles, basement pipes, and heating air ducts is inadequate and is responsible for a lot of service headaches.

He cites two recent cases of "snow" that were traced to a foundation grille and a metal casement window. Vibration had cut through the insulation in the first case and closing pressure had destroyed the insulation in the second case. He suggests that what was true in these two cases could also apply to tension window screens or ordinary screen wire used on enclosed porches if the lead-in comes in contact with those surfaces. —30—

★ ★



Send 10c to Sprague for window-size blow-ups of this message

ARE SERVICEMEN GYPS?

Every so often, some national magazine sounds off about radio-television servicemen.

"Servicemen are a bunch of gyps," is the general theme. "They'll clip you if you don't watch out."

They might just as well write the same thing of doctors, lawyers, storekeepers, auto mechanics—or anyone else. There are gyps in every line. Actually, the percentage in radio is far lower than in most.

The average serviceman—and I have met thousands during 30 years in radio parts manufacture—is a hard-working, straight-shooting individual. Rather than gyp customers, he is far more likely to spend more time on a job than he knows he will be paid for—simply as a matter of personal pride in doing things right.

The other evening, a friend's TV set went bad. A serviceman called for it in his truck and returned it in good working condition within 48 hours. His bill came to $10 for service plus $2.68 for replacement parts.

My friend argued that this was too much—yet he would never dream of complaining to the medical specialist who charged him $10 for a 15-minute office visit; the lawyer whose bill for writing a simple will was $75; or the garage man who, as my friend laughingly admits, charges $5 for "just raising the hood" of his car.

In a large Eastern city having over 800,000 TV receivers, the Better Business Bureau received complaints about service on only 1/10 of 1% of the sets in a year. Investigation showed that most of these came from folks who expected first-class reception in doubtful fringe areas; who tried to operate their sets without suitable antennas, or who had bought sets "wholesale" or at ridiculously low prices from cut-rate dealers who could offer little or no service.

Actually, it takes almost as long to become a good serviceman as it does to train for any other profession. Beyond this, it calls for regular study to keep up with the constant stream of new developments. Also, it requires a surprisingly big investment in test instruments, manuals and other shop equipment. The modern radio or TV receiver is by far the most intricate piece of equipment the average person ever owns or uses.

Servicemen are not fly-by-night businessmen. Ninety-nine out of 100 radio-television servicemen run their businesses properly. The other one per cent—the gyps—can usually be spotted a mile away. Nine times out of ten, they are the shops that feature "bargain" prices and ridiculously liberal service contracts. And their victims are generally set owners who expect to beat the game by "getting something for nothing."

Good television sets or good TV service are not things to be bought on a "bargain counter" basis. Set owners who recognize this aren't likely to get gypped.

Instead, they'll find that they get more real value for their television entertainment dollars than for almost any other dollars they spend!

Harry Kalker

PRESIDENT

SPRAGUE PRODUCTS COMPANY

(Distributors' Division of the Sprague Electric Company)

North Adams, Mass.

SPRAGUE

WORLD'S LARGEST CAPACITOR MANUFACTURER



RADIO-TV Service Industry News

AS REPORTED BY THE

TELEVISION TECHNICIANS LECTURE BUREAU

WHEN major changes occur in a basic business activity they seldom happen with dramatic speed. This is especially true when the affected business is a supplementary part or function of a development of first magnitude such as occurred with the widespread public acceptance of the automobile, electric refrigerator, the self-service cash-and-carry grocery store, and recently, of course, television. Each of these developments gradually brought about tremendous changes in our pattern of living and in so doing they created a myriad of new types of businesses with their inherent opportunities. At the same time they smothered the businesses that had been serving the outmoded method that the new development had displaced.

The transition of a business activity to meet the peculiar needs of the market for newly created products occurs subtly and comparatively slowly. When something radically new is created it first seeks its markets through existing business channels. From this it gradually expands to create its own economic pattern and in so doing remains profitable only to those business enterprises which are able to adjust their methods of operation to meet its individual needs. In the early days of the automobile, gasoline was handled by drug stores and automobiles were repaired by blacksmiths.

The statistics that eventually give us the true picture of what has been a major business transition usually lag so far behind the development that when they are published we learn what has *happened* instead of what is *happening*.

However, spot surveys that are being made at regular intervals by competent market analysts will often disclose a definite trend which, to the alert businessman, can be of invaluable assistance in helping him to project long-range plans.

As an example of how statistics definitely indicate a trend, back in 1948 the "Service Trades" bulletin included in the U. S. Census of Business for that year, in referring to "radio repair shops," showed that in 1939 there were 10,732 shops operated by 11,000 active proprietors with 2842 employees. In 1948 there were 12,588 shops operated by 12,955 active proprietors with 10,-262 employees. Gross receipts per shop increased from $21,687 in 1939 to $100,-679 in 1948. Payrolls increased from $2004 per shop in 1939 to $20,791 per shop in 1948.

From these figures it is evident that while the number of shops increased only a scant 20%, the number of paid employees increased nearly five times or at about the same rate as gross income. The number of proprietors increased at a slower rate than the number of shops. These figures bring the situation up only to 1948, however, when the greatest swing in the transition of the service business had not yet come about.

Since then it has become increasingly evident that the television service business has not only shown a definite pattern of growth but that it is also following, to a recognizable degree, the pattern of other large service industries.

The new stature of television service as a business was succinctly described by Louis J. Smith, a prominent television service contractor in Philadelphia, Pa., during a recent interview on the "People's Forum" program aired by radio station KYW of Philadelphia. In reply to questions about the Television Contractors Association (TCA) and its function in the radio and television service business, Mr. Smith said:

"TCA is a group of television and radio service contractors who, in this complex electronics age, are most intelligently geared to provide the best and the maximum in service to the consumer. They have office staffs to handle customer requests and to dispatch service calls. They have complete libraries of all diagrams necessary to guide the competent technician in doing a good job. They have vehicles specially fitted to provide speedy transportation for the technician, his equipment, and spare parts so that the consumer is most efficiently served. They have completely fitted service shops that have all of the test equipment that is needed, together with a well-stocked parts department which contains the most needed parts.

"With the advent of television, an

NIAGARA TOPS 'EM ALL!

SYNCHRO-SELSYNS

All Brand New



Machine aluminum housing and case. Bakelite end cap with coded screw terminals. ¼" shaft.

C-78249 Cal. 11280 Synchro Differential 100 V. 60 Cycle. Price **$3.75**

C-78473 Cal. 13929 Repeater type XX 50 V. 50 Cycle. Price..... **3.75**

C-78411 Cal. 11925 Transmitter 50 V. 50 Cycle. Price..... **3.75**

The below listed type is similar to above, but contained in a solid machined bronze housing. 5 leads 5 ft. long, of color coded fiber glass insulation are provided.

C-56776-1 Ca-4460A-4 Repeater type 11-5 110 V. 50 Cycle. Price..... **$7.50**

National

SW-54

$49.95



Sleek, Low-Priced, Beauty in a Compact General Coverage Receiver.

11" x 7" x 7"

NATIONAL SW54 *IN STOCK*

WRITE FOR FREE LITERATURE

REMOTE CONTROL FOR THE ?? THING! ??

(Plus $1.00 Book FREE!)



The answer to the "Remote Control" Experimenter's dream! A completely wired, 5-tube Remote Control Unit, originally used as ELECTRONIC BRAIN for remote thermostatic control of electric blankets. Can be used, with slight modification, to control model trains, planes, trucks, remote on-off for radios, open and close garage doors from your car, or to remotely control any device in accordance with your own ingenuity. AND THAT'S NOT ALL! With each unit we will give you, ABSOLUTELY FREE, one copy of Gernsback Library's popular new book "Model Control by Radio." 112 pages containing more than 125 illustrations, diagrams, tables, formulas, crammed full of theory and practical uses for electronic remote control. Remote control unit, including 9l, xfmr, 3000 ohm plate circuit "Sigpo" relay, completely wired with circuit diagram, and above described book, less tubes. Shpg. wt. 3 lbs. All for only..... **$5.50

WHEELER *Sound-Powered* HANDSETS



Model SPT-102

$9.62 EACH



$36.96 EACH

MODEL SPS-205 MI
12 STATION MASTER
Selective Ringing Intercom

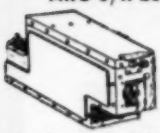
IF YOU are involved in the present rapidly expanding range of electrical and mechanical control and communication products, we have something that may be extremely interesting to you. Wheeler Voice Powered Telephone Systems represent a considerable background of pioneer research and development. Today, this product, technically and commercially mature, has broad uses in both military and civilian fields. But over and beyond these standardized designs and applications they make many special high level handset units and signaling components for "built-in" applications. Further information on request.

WRITE FOR FREE COMPLETE WHEELER CATALOG.

ARC-5/R-28 RECEIVER

100—156 Mcs.

New or Used



Here is the aircraft superhet you have been looking for. Absolutely one of the best available today. Tunes from 100 to 156 mcs. in four crystal channels. Accurately calibrated dial on front panel. Contains the following tubes: 717a—R.F., 717a—Mixer, 2—12SH7—1st and 2nd I.F. (16.9 mc.), 12SL7—Det., AVC, Squelch, 12SL7—1st audio, and squelch amplifier, 12A6—2nd audio, 12SH7—R.F. Osc. and 4th harmonic gen., 717a—trip. 12th Harmonic gen., 717a—Dblr. 24th Harmonic gen. (all tubes are included.)

New, in sealed cartons..... **$24.95**

Used, excellent condition..... **$20.95**

T23/ARC-5 TRANSMITTER

FAMOUS AIRCRAFT TRANSMITTER. COMPANION TO ABOVE RECEIVER.

A desirable VHF transmitter with turret switching coils for all stages. Uses the following tubes: 1625 Osc., 1625 Tripler, 832 Tripler, 832 Final amplifier. Range: 100 to 156 Mcs. Four crystal channels are provided.

Brand new with all tubes, less crystals..... **$39.95**

A HIGH PRECISION VTVM KIT By

EICO

TOPS ON ANY WORK BENCH!



Versatility plus! 15 different ranges. Resistance ranges from 2 ohms to 1000 megohms in 5 steps! Exceptionally accurate. Big 4½" fused meter. Dozens of features too numerous to mention. Sum it up in one word.

TERRIFIC!

EICO VTVM KH No. 221K..... **$25.95**

EICO VTVM, wired and tested..... **49.95**

Write for Free EICO Catalogue

HEART OF THE BC-221

FREQ. METER



This VFO Sub-Assembly, used in BC-221 Freq. Meter, is ideally suited for home construction of: 1—Amateur V.F.O. 2—Freq. Mtr. Foundation. 3—Portable Transmitter. 4—Replacement for BC-221. Unit contains two temperature and moisture compensating coils, wafer switch, 3 variable condensers, carbon resistors and silver mica condensers. FULLY WIRED and mounted on sturdy aluminum sub-chassis, ready for installation. Brand new—in original packing.

New Low Price **$4.95**

WEBSTER CHICAGO AUTOMATIC RECORD CHANGER

3-SPEED

SERIES 100-7S

WITH FLIP-OVER CARTRIDGE



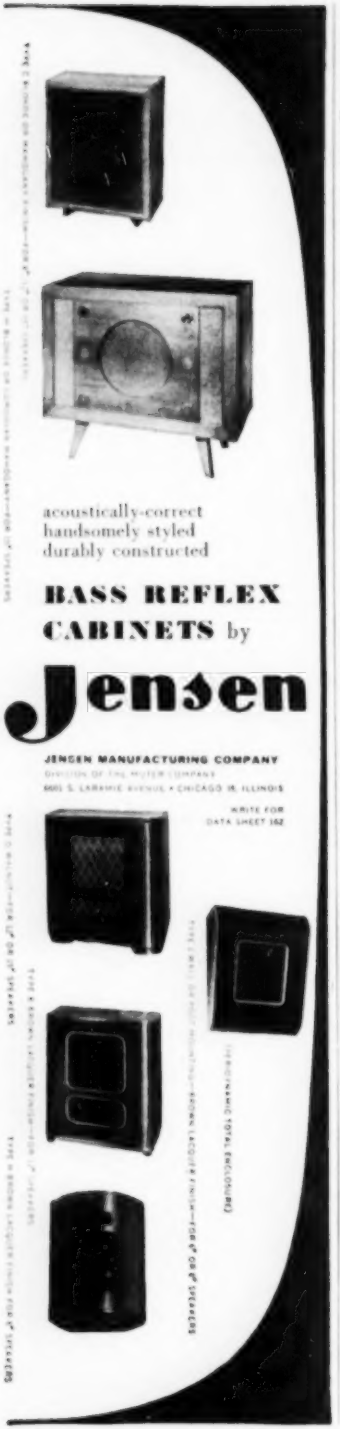
Fine, new record changers at less than regular manufacturer's cost. Made by Webster-Chicago and only introduced on the market a few months ago as one of their latest models. Plays 12, 10 or 7 inch records at 33⅓, 45, or 78 R.P.M. New spindle carefully lowers unplayed record stack. Balanced arm assures light needle pressure and long wear. Needle-tip (included) for standard or micro-groove records. In-side-out records played without any adjustment. Pickup arm comes to rest position after last record has played. Complete factory packed and sealed record changers, normally listing at $47.50—While they last. Shipping Wt. 15 lbs..... **$24.85**

ONE OF AMERICA'S GREAT RADIO STORES

Niagara RADIO SUPPLY CORP. R-3-2

Digby 9-1133-3-4

160 Greenwich Street, New York 6, N. Y.



acoustically-correct
handsomely styled
durably constructed

BASS REFLEX CABINETS by

Jensen

JENSEN MANUFACTURING COMPANY
DIVISION OF THE MUTER COMPANY
6601 S. LARAMIE AVENUE • CHICAGO 38, ILLINOIS

WRITE FOR DATA SHEET 102

instrument that has six to ten times the parts of an average radio, combining audio and video (voice and sound), we found that many more facilities, test instruments, and non-technical people (such as clerks, dispatchers, cost accountants, supervisors, etc.,) were needed to conduct an efficient, consistently reliable service business. The radio technician who, in addition to his technical qualifications, possessed the business qualifications needed to operate such a business soon developed into what is known as a 'service contractor.' This new businessman-technician soon found that the major part of his activity was concerned with the details of business management of the operations. He hired a service manager to take care of technical problems.

"With business problems his foremost interest the service contractor, like businessmen in other fields, observed the need for a trade association which would enable him to exchange information and knowledge with his competitors on common problems for their mutual good and for better service to the consumer. The natural culmination of this thought was the organization of the Television Contractors Association."

The business aspects of television servicing are clearly reflected in the following statement about television servicing business possibilities in 1952 which was made recently by a prominent TV market research specialist:

"There will be plenty of business for the TV serviceman in 1952. The rapid growth of television markets will make his business more active but it will also create tremendous problems. He will face new financing problems, will probably have to expand the space his business occupies. He will find that expanding operations will mean he will have to hire more help, find and train salesmen. He will also be faced with problems of supervising expanded operations and will have to assume the moral obligation that goes with assisting in the training of repairmen in problems pertaining to technical knowledge, business knowledge, and business ethics."

Turning again to statistics to get a clear picture of the reasons for this vast transition in the service business, the following figures from the 1951 edition of "National Income" published by the Bureau of Foreign and Domestic Commerce, Office of Business Economics, U. S. Department of Commerce depict the tremendous increase in dollar volume of business that has occurred in the radio-television servicing industry during the past ten years:

(These represent over-all expenditures in millions of dollars.)

1941	$ 36
1942	46
1943	59
1944	70
1945	84
1946	114
1947	135
1948	172
1949	206
1950	272

These figures indicate that during

PHOTOCON SALES

1062 N. Allen Ave. SYcamore 4-7158
Pasadena 7, Calif. RYan 1-8271

WRITE FOR OUR WINTER SURPLUS SALES CATALOGUE

WE WILL BUY YOUR NEW OR CLEAN USED ELECTRONIC SURPLUS. ARC-1, ARC-3, BC-224, BC-348, BC-312, BC-342, ATC, ART-13, APS-13, BC-221, LM's, TS-12, TS-13, TS-23, TS-34, TS-35, IE-19A, I-222, SCR-522, TS-100, or any BC, I, IE, TS, APR.

WRITE FOR PRICES:
APR4, TS13/AP, TS31/AP, TS148/UP, ARC1, ART13, APA11, TS184, TS251, etc.

DuMont 208 5" Oscillograph	EXCELLENT	$225.00
804B General Radio Signal Generator 8-330 mc.	EXCELLENT	300.00
APN-1 Altimeter Indicator 0-1 ma. shunt, 250° dial	NEW	2.95
LM & BC-221 Frequency Meter with cal. book, crystal, and tubes	EXCELLENT	99.50
SCR-625 Mine Detector	NEW	69.50
	USED	39.50
AN/APN4B Complete	EXCELLENT	150.00
PE-218 Inverter 400N	NEW	29.50
Weston Model 545 Tachometer Meter	NEW	17.50
HS-33 600 ohm Headsets	USED	3.50
	NEW	5.95
400 cycle Inverters—G.E. 5D21NJ1A Input 24V. DC. Output 115V. AC. 400 cycles 485 V.A.	NEW	24.50
DuMont 241 Oscillograph	EXCELLENT	300.00
G.E. Oscillograph CR05Y	EXCELLENT	229.00
Drafting Machine single scale 16" Fulcrum less scale. Exc.		35.00
CRT-3 Two-Channel Gibson Girl	NEW	75.00
DuMont 224 Oscillograph less front cover	EXCELLENT	125.00
TS173/UP Freq. Meter	EXCELLENT COND.	600.00
Genescope—Superior 480	NEW	340.00
I-96A Signal Generator	LIKE NEW	375.00

NOTE: One of the largest and most complete electronic surplus stocks in the country. We have thousands of tubes, capacitors, plugs, accessories, transmitters-receivers, test equipment, etc. Send us your requirements.

TERMS: Prices F.O.B. Pasadena, California. 25% on all C.O.D. orders. Californians add 3% Sales Tax. Prices subject to change without notice.



the past ten years the dollar volume of business flowing into radio-television service shops increased more than seven and one-half times. They also show that the increase has been getting greater each year and especially so since 1948. This fact alone is quite interesting in view of the station construction freeze which prevented the opening of new television receiver markets during the same period.

On the basis of these statistics it is obvious, too, that the opening of new telecasting areas after the station construction freeze has been lifted, will greatly accelerate the increase in the dollar volume of service business in the years immediately ahead.

The conclusion to be drawn from these figures is simply that present television service businesses must prepare to expand their facilities and personnel to handle a growing volume of business or new radio-television service businesses will come into being to handle the growth.

New TV Areas

The green light on the construction of u.h.f. telecasting stations will immediately create a potential of more than one thousand new cities and towns that will be primary signal areas. At the present time a large percentage of these areas are fringe, far fringe, or completely out of the signal areas of present telecasting stations. They will be, in effect, brand new television markets and provide very fertile ground for new television service businesses.

Television at the ultra highs will present many new problems to the service forces of the industry that they have not had to contend with in the present v.h.f. ranges. It is quite probable that every u.h.f.-v.h.f. television receiver sold in a primary u.h.f. signal area will include an outdoor antenna installation, a rotator, and perhaps a booster. The reason for this is that the majority of cities and towns where new u.h.f. television stations are constructed will also be in the fringe areas of other u.h.f. as well as v.h.f. stations. Customers who purchase receivers with facilities for tuning in twelve stations will want to get the maximum number of stations possible in the area in which they live. Alert set retailers and servicing contractors in those areas will quickly learn to take the same advantage of this potential market for supplementary sales as the service contractors have done in the fringe and far-fringe areas of present telecasting stations.

Radio service operators whose businesses are located in cities where the first local telecasting station will operate on a u.h.f. channel can probably anticipate installation requirements in their localities by studying the v.h.f. and u.h.f. channel allocations for nearby cities.

The Television Technicians Lecture Bureau has prepared a lecture on u.h.f. television which covers complete conversion and alignment instructions on



PRODUCT DEVELOPMENT ENGINEERING

will keep it that way

You have less sales resistance to overcome when you sell Teletowers. You offer a product that "towers" above all competition in consumer acceptance. Teletowers lead in sales because Teletowers lead in product development engineering.

Here are just a few of the popular and effective engineering features developed by Teletowers (1) The straight top section (2) The adjustable roof mount (3) The built-in base (4) The universal motor mount.

Remember—Teletowers top your "roof-top market" . . . and since they're going to stay up there . . . it will pay you to *stay tuned in with Teletowers!*

CANADIAN REPRESENTATIVE:
Atlas Radio Corp., Ltd., 560 King Street, W. Toronto, Canada.

Penn's Universal Motor Mount is easily and quickly adapted to *all* antenna rotors.

PENN Teletowers Driftowers Penna-Mast Hardware

PENN BOILER & BURNER MFG. CORP., LANCASTER, PA.



all tests demonstrate
PEERLESS
superiority


Competitor No. 1


Competitor No. 2


Competitor No. 3


Competitor No. 4

Comparative square wave tests on transformers shown all over the country have demonstrated Peerless superiority... Now Peerless emphasizes another very important property of transformers as shown by the "exciting current test." An output transformer's ability to deliver plenty of clean, low frequency power (the goal of every music lover) is inversely proportional to the amplitude and distortion of its exciting current.

PEERLESS superior low frequency power handling capacity is illustrated in these comparative oscillograms.

Write for complete data.

PEERLESS
Electrical Products
9356 Santa Monica Blvd.
Beverly Hills, Calif.
261 Sixth Avenue
New York 14, N.Y.

Division
ALTEC
LANSING CORPORATION

For High Fidelity
Multiple Speaker Installations
You Must Have

CROSSOVER NETWORKS

General Apparatus specializes in low cost, low frequency crossover networks and high inductance air core chokes, not available elsewhere at anything like our prices. For instance, here are X-over frequencies and prices for our 8-ohm networks.

85 CYCLES	$26.50
175 CYCLES	$24.00
350 CYCLES	$17.50
550 CYCLES	$13.00
1100 CYCLES	$12.00
2200 CYCLES	$11.00

These are sharp attenuation networks (12 db) and are complete with TWO coils, capacitors, and level controls. Coils are wound with heavy No. 17 enameled copper wire. They are available separately at the following prices per coil: 10.2 Mh. $10; 5.1 Mh. $6; 1.6 Mh. $3.50; and 0.8 Mh. $3.00.

Order directly from this advertisement or send 10c for instruction sheet giving complete details.

All shipments C.O.D. unless accompanied by remittance in full plus 75c for postage and insurance.

General Apparatus Co.
Dept. D P.O. Box 182
SOUTH EGREMONT, MASS.

IT'S A SALES NATURAL
Because It's
TIP-PROOF



JFD
Tip-Proof
Model No. TA 135
INDOOR TV ANTENNA

Complete with twin lead.

Closes TV set sales on-the-spot. One reason why over 1,000,000 have already been sold!

See Your Jobber or Write for Brochure No. 16

JFD MANUFACTURING CO., INC.
6129 16th Ave. Brooklyn 4, New York

u.h.f. tuners and demonstrations. This lecture is now available for presentation in any community in the United States. Information on this non-commercial presentation of u.h.f. television may be obtained from local radio parts distributors or by writing the Bureau at P. O. Box 1321, Indianapolis 6, Indiana.

It has been interesting to observe that, where they have been competently managed, TV installation and service businesses in the fringe and far-fringe areas of present v.h.f. stations have generally been very successful and profitable. There is a two-fold reason for this. In selling receivers in fringe areas set dealers learned early in the game that it was business suicide to over-sell the reception that could be consistently expected in a fringe location. They also found that it was not necessary to over-sell the performance of the receiver when the buyer was properly sold on the wonders of television itself.

In far-fringe and many fringe areas the cost of a satisfactory antenna installation with a mast or tower, rotator, and one or two boosters, sometimes equals the cost of the receiver itself.

The set dealer or installation and service contractor who handles this class of business has to make a substantial investment in installation and servicing equipment. This requirement shuts out the shoestring operator and leaves this business in the hands of businessmen who know that consistent and satisfactory television service can be maintained only when such service businesses are operated at a profit.

A television service business capable of handling the installation and servicing requirements of receivers in these new u.h.f. areas will require a substantial investment in automotive equipment, tools, supplies, and replacement parts and accessories. It will also require the services of skilled installation technicians as well as shop and field servicing technicians to carry out the business at a profit.

As each new u.h.f. television area is opened there will be a minor boom in receiver sales and in installation and servicing business. After this initial boom has subsided, managers of the television service businesses that it created will be faced with the same problems of maintaining a satisfactory volume of business, as the service contractors in present v.h.f. areas.

Service Salesmanship

There are three basic ways to operate a retail business and radio-television service is a retail business with the profitable sale of labor as its major product.

The first way is to open a store or shop and depend upon street traffic, a listing in the telephone directory, and an occasional small-sized ad in the local paper to bring in the work needed to keep the business going. This is definitely a negative approach to running a business because the most im-



BC603 INTERPHONE AMPLIFIER

Easily converted to an ideal inter-communications set for office—home—or factory. Complete w conversion diagram for 110V operation.
Brand New **$4.75**

DYNAMOTORS

Type	Input Volts	Amps.	Output Volts	Amps.	Radio Set
PE86	28	1.33	250	.060	BC314
DM41S	14	6.2	330	.170	RU 19
DM32A	28	7	540	.250	BC 456
PE101C	11.26	12.6	400	.135	SCR 515
		6.1	180	.070	
BD AM 53	28	3.25	375	.150	
23156	27	1.75	285	.075	APN-1
ZA0515	12.24	4.2	500	.050	
B-19 pack	12	9.4	275	.110	MARK II
			500	.050	
D-104	12		225	.100	
			440	.200	
DA-3A	28	10	300	.040	SCR 522
			150	.010	
			14.5	.5	
5053	28	1.4	250	.060	APN-1
PE73CM	28	19	1000	.350	BC 375
CW21AAX	11	12.6	400	.135	
	26	6.3	800	.020	
		9	1.12		
PE94	28	19	180	.300	SCR 522
			150	.103	
			14.5	.5	

INVERTERS

PE-218-E: Input: 25 28 vdc. 92 amp. Output: 115v. 350-500 cy. 1500 volt-amperes. Dim. 17"x8½"x10" New **$34.50**

PE-218-N: Same as above, except size: 16½"x8"x10" New **$34.50**

PE-286: Input: 28 vdc. 38 amp. Output: 80 v 800 cy. 500 volt amps. Dim: 13"x5½"x10½" **$22.50**

FULL WAVE BRIDGE SELENIUM RECTIFIERS

Up to 18v. RMS a.c. Input—Up to 14v. d.c. output	
Max. d.c. amps.	Price
2	$ 2.50
4	4.00
6	5.00
10	7.50
12	9.00
20	15.00
24	18.00
30	21.00
36	27.00
Up to 36v. RMS a.c. Input—Up to 28v. d.c. output	
1	3.00
2	4.50
4	8.00
10	14.50
12	18.00
20	28.00
24	28.00
30	36.00
36	42.00
36	54.00
Up to 54v. RMS a.c. Input. Up to 42v. d.c. @ output	
2	6.50
4	8.50
Up to 115 v. RMS a.c. Input—Up to 100v. d.c. output	
2	11.00
10	48.00
12	60.00

SPECIAL RECTIFIERS ON REQUEST
Low-Voltage Transformers Primarios 115v., 60 Cycle
36V-40V at 3.5 amps $3.75
24V-1.5A 1.95
8V-1.5A 1.95
16V-4.5A 2.95

HI CAP. FILTER CONDENSERS

Cap. Mfd.	WVDC	Price
2000	6	$1.95
500	200	2.00
250	150	1.45

A.C. ELECTROLYTICS

CAP.	VAC.	PRICE
13-15	220	$ 1.20
70-74	110	1.00
16-20	220	1.35
43-45	110	1.25
43-48	110	1.25
50-75	110	1.25
53-60	220	1.50
61-69	220	1.60
64-72	110	1.25
72-87	110	1.25
75-84	110	1.25
88-106	110	1.50
107-129	110	1.65
138-157	110	1.75
130-158	70	1.50
130-160	110	1.85
158-191	110	1.85
161-188	110	1.75
189-230	110	1.95
200-220	110	1.95
270-300	110	2.10
324-360	110	2.40
378-428	175	3.00
432-468	110	2.75
485-540	110	2.85

OIL CONDENSERS

Mfd.	Volt	Price
.5	50	$ 0.45
650	80	1.95
15	220 AC	2.20
0.5	750 AC	1.50
0.5	1000	.65
2x0.5	1000	.70
1	1000	.75
1.5	1000	.85
2	1000	.90
4	1000	1.75
3x.01	1200	1.15
1	1500	1.30
1.5	1500	1.40
2	1500	1.45
0.15	4000	1.20
2x0.1	4800	1.20
0.1	6000	2.39
1.5	6000	17.50
2x0.1	7000	2.95
.015	16000	3.95
.0016	15000	5.95
.25	20000	
1	25000	
.5	25000	
1	25000	

MANY OTHERS

VARISTORS

D-167376	$ .95
D-167215	2.25
D-166487	.95
D-171612	.95
D-171528	.95
D-162356 (308A)	1.50

THERMISTORS

D-166228	$ 1.50
D-167312 (tube)	1.50
D-170396 (bead)	1.50
D-167613 (button)	1.50
D-166699 for MTG "X" band Guide	$2.50

LINE FILTERS

LINE FILTER. GE 100 Amp Filter w/2x5 Mfd 50v oil cond. Operates on 115VAC DC $1.39

1KW LINE FILTER, clean up BCI & TVI. Easy to Mount $3.95

Noise Filter. Js51E. 10 Amp $1.29

Noise Filter. Js55D. 4 Amp. 35c

932 PHOTO TUBE



Gas Photo-tube having S1 response, particularly sensitive to Red and Near Infrared Radiation. Can be used with incandescent light source. Send for Data. Price 75c

POWER TRANSFORMERS

Comb. Transformers—115V 50-60 cps input.

CT-778	5300V @2A, 2.5V/2A, 12KV TEST		
	6.3VCT/6A—4600V TEST		$12.95
CT-758	1200VCT 600MA, 2X.3VCT, 6.2A		
	6.3VCT/3A, 6.3V/3A		14.95
CT-825	360VCT	.340	6.3VCT/3.6, 6.3VCT/3A	3.95
CT-626	1300V	.160	2.5/12, 30/100	9.95
XF-15A	350VCT	.070	6.3/.6, 6.3/1.8, 7.5/1 lbs	2.95
CT-671	110V	.200	33-200, 5V/10-2.5/10	4.95
CT-378	2300V	4 MA	2.5/2	6.95
CT-367	580VCT	.030	5VCT/3A	2.25
CT-721	550VCT	.100	6.3/1, 2.5VCT/2, 5V/3A	2.95
CT-99A	2x110VCT	.010	6.3/1A, 2.5 VCT/7A, 5V/3A	3.25
CT-681	350VCT	.026 MA	5V/3A	2.75
CT-931	585VCT	.035	5V/3A, 6.3V/6A	4.25
CT-610	1250	.062 MA	2.5V/2.1A, 2.5V/1.75A	4.95
CT-137	350VCT	.026 MA	5V/3A	2.75
CT-866	330V	.065	6.3V/1.2, 6.3V 600 MA	3.75
CT-456	390VCT	30 MA	6.3V/1.3A, 5V/3A	3.45
CT-168	800VCT	.100 MA	6.3V/1.2A, 5V/3A	4.95
CT-931	585VCT	85 MA	5V/3A, 6.3V/6A	4.95
CT-442	525VCT	75 MA	5V/2A, 10VCT/2A, 5CV/2A, 50V/200 MA	3.85

Filament Transformers—115V 50-60 cps input.

Item	Rating	Each
FTG-31	2.5V/2.5, 7V/7A (Tape @ 2.5V/2.5A) 10KV	$ 9.95
FT-674	8.5V/1.5A	1.10
FT-157	4V/10A, 2.5V/1.75A	3.95
FT-103	6V/.25A	.75
FT-524	5.25V, 21A, 2x2.75V/6.5A	17.95
FT-184	6V/.5A	4.75
FT-624	2x26V/2.5A, 16V/1A, 7.2V/7A, 6.4V/10A, 6.4V/2A	12.95
FT-661	6.3V/3.5A, 2.5VCT/3A, 5VCT/3A	5.49
FT-55-2	7.2V/21.5A, 6.3V/6.85A, 5V/6A, 5V/3A	8.95
FT-506	16V @ 4.5A or 12V @ 6.5A	2.69
FT-30A	6.3/2.5A, 2x2.5V/7A	4.19
FT-A27	2.5V/2.5A, 7V/7A, TAP 2.5V/2.5A, 10KV TEST	18.95
FT-348	2x2.5V/3A, 7V/7A—23KV TEST	24.95
FT-038	6.3V/500A WELD	29.45

Plate Transformers—115V 50-60 cps input.

Item	Rating	Each
PT-919	1200-0-1200/200 MA	$ 8.95
PT-976	Auto: 120VCT/10 MA	.65
PT-31A	2x300V/5 MA	.79
PT-46A	4080VCT N.L. 3% to 18" Hx9" Wx7" L, 20 lbs.	29.95
PT-75-2	3780-3446/3112VCT/77MA	10.95
PT-28-1	4600VCT/.077	12.95
PT-493	Auto: 70V/1A	2.29
PT-169	1120VCT/770 MA, 580VCT/82 MA, 25 lbs.	24.95
PT-178	Auto: 136/146/137/128—.71A	2.29
PT-31A	2x300V/5 MA	.79
PT-976	120VCT/10 MA	.79
PT-12A	280VCT/1.2A	2.95
PT-634	6730VCT/500MA, 12KV INS	29.95

Special Filament Transformers

Item	Pri.	Output	Price
STF-95A	115/230	2x5V/7.5"Hx7"x5" D	$ 4.25
STF-96B	230	2.5V/6.5A	4.95
STF-379	220/440	3x2.5V/57, 2.5V/15A, 5½ x5½x6½	5.25
STF-11A	220	2x40V, 05/2x5V/6A, 12.6/1A	2.95
STF-631	230	2x5V/27A, 2x5V/9A, 100/ 4Hx5x7" lbs	24.95
STF-378	220/440W	3x2.5V/5A, 2.5V/15A	9.95
STF-665	220/440V	2.5V/60 ACT	15.95
STF-683	220/440V	5VCT/30A, 3000V TEST	17.50

115 V—400CY XFMRS

Stock	Ratings	Price
901699-501	2.77V @ 6.25A	$ 3.45
901698-501	900V/75 MA, 190V/.04A	4.29
UX8855C	900VCT/.067A, 5V/3A	3.79
RA6405-1	800VCT/.65MA, 5VCT/3A	3.69
Y-48852	700VCT/.80 MA, 5V/3A, 6V/1.75A	4.25
352-7098	2560V/6MA, 300VCT/.135 MA	5.95
MS-9336	1100V/30MA Tapped 625V, 2.5V/5A	3.95
M-7474359	6.3V/2.7A, 6.3V/.66A, 6.3VCT/.21A	4.25
MS-8984	27V/3A, 6.3V/2.9A, 1.25V/.02A	2.95
52C080	526VCT/50MA, 6.3VCT/2A, 5VCT/3A	3.75
32332	600VCT/.35MA, 6.4V/2.5A, 6.4V/15A	3.85
68G431	1150-0-1150V	2.75
90G139	6VCT, 60cps KVA	1.75
D-167254	6.4V/8A, 6.4V/1A	2.79
182435-A	6.3V/9.1A, 6.3VCT/6.5A, 2.5V/3.5A, 2.5V/3.5A	4.85
MS-9445	59.2VCT/.04MA, 6.3V/8.1A, 5V/2A	5.39
MS-9685	6.4V/2.5A, 6.4V/3.8A, 6.4V/2.5A	4.79

ALL CT

70G30G1	600 VCT/.36 MA	2.65
M-7474310	2100V/.027A	4.95
95-G-45	2000V/.002A, 2000V, NL, 465V/.6A 5V/10A, 6.3V/2.5A, 6.3V/1.8A, 5V/9A, 2X2.5V/1.75A	17.95

SPECIALS

Time Delay Relay—45 Sec. 115VAC-DC 10A	$ 2.29
Carbon Pile Reg. 18V—5V—35X.025	—
ART 13 Driver Trans. 6V6 to P-P 811's	1.29
D M34 Dynamotor, 14V In, 220V, 80 Ma out	9.95
Sens. Relay. 3.5 MA, 13K ohms, 2PST, 2A	1.29
Klixon Breaker, Thermal, 35A	.69
T 30 Carbon Mikes—New	.99
Screen Mod. Trans. for 807's	1.49
3.4 MC coils for ARC-5 Trans. #6029, #7247, Sec.	1.79
RI-7 Interphone Amplifier	2.39
Filter, LoPass, 10,000 ohm imp.—20 d.b. down at 6000 CPS GR#830-604	2.35
Photo-Print Paper 3.5 MM. Strip, 250 Ft. Roll, 62 contrast Vacuum Pack—Guaranteed, 79c each or 3 Rolls for	2.00
Teletype Tape, ¾" W x 4" Rolls, 12c Each. 10/	1.00
Sq. Rolls, 25c Each or 3 for	1.00
BC 306 ANTENNA TUNING UNIT, NEW	6.95
R9, APN-4, New, With Tubes	75.00
II06 APN 4, New, With Tubes	75.00
A-62 Phantom Antennae	6.95
2 Meter Choke, 1000 MA, Zo=144 ..... 8/	1.00
Supersonic Crystal Head, M-1	27.45
Underwater Microphone, Model JR	24.50
Dynamic Mike & Headset Combo. B-19	3.75
HS-30 Inserts. M-300 ..... 1000/	1.50
Motors, 3 RPM, 115V, 60 cy	1.85

POWER EQUIPMENT

STEP DOWN TRANSFORMER: Prt. 440/220/110 volts a.c. 60 cycles. 3KVA. Sec. 115v. 2500 volt insulation. Size 12"x10"x7" **$40.00**

PLATE TRANSFORMER: Pri: 117v. 60 cy. Sec. 17,600 @ 144 ma. with choke. Oil immersed. Size: 28"x20"x15" American **$120.00**

FIL. TRANS. UX6499. Prt.: 115 v., 60 cy. Sec. 7½ 5.5 amp. wdgs. 29 KV test **$24.50**

VOLTAGE REG. Transtat. Amertran type RH 2 KVA load, Input: 90/130 v. 50-60 cy., output 115 v. **$45.00**

UX 6301 (Raytheon): Prt.: 110 v. 60 cy., 1 ph. Sec.: 22,000 v. 234 ma., 5.35 KVA., Dim: 23"x24"x10" ..... Capacitor **$185.00**

FIL XFMR. Kenyon: Prt.: 210/215/220/225/230/235/240 vac. 60 cy. Sec.: 11 v., 35 amp., 10 t., 35 amp ct., 7.5 v. 35 amp ct. 5v. 35 amp ct. #8-10768 ..... **$37.50**

FIL TRANS. KS8767: Prt.: 115 v., 60 cy. Sec.: 2 windings: 6.5 amps each 15 KV test **$15.00**

A/N TEST SETS

TS 35A/AP	1-155	TS 67/APR	TS 250/APN
CW60-ARM	1-222	TS 36/AP	TS 69
LU-1	1-185	TS 12 UNIT 2	1-303-A
LU-3	TS 268/U	Q. METER	TS 11/AP
TS 155	TS 69/AP	TS 226	BC 453
CS-40ABW	TS 102/AP		

SEND FOR FURTHER INFORMATION AND PRICES

B-19 MK II TRANSRECEIVER
Less Power Pack $32.50
B-19 Power Pack 8.95



ID-26 ARN-5
Dual 0-200 Microamp. Movement in 3" case. ILS Equipment $8.95

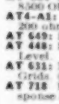


ARC-5 MODULATOR
MD7/ARC5 Plate Modulator w dynamotor complete w 7 tubes, 1—1625, 2—1625, 1—VR150. Good cond. Price $7.95

FILTER CHOKES

Stock	Description	Price
CH-250	8WING 2.5-24H/4-65A 10KV Test	$7.95
CH-8-19	8WING .006H/3A-035H/5A, .032 ohms DCR, 2.5KV TEST	3.95
CH-776	1.2H/130 MA/75 ohms	2.25
CH-344	1.5 H/145 MA/1200V Test	2.35
CH-854	1 HY/80 MA	1.29
CH-412A	10 HY/15 MA—850 ohms DCR	1.75
CH-999	15 HY/15 MA—400 ohms DCR	1.95
CH-511	6 H/80 MA—310 ohms DCR	2.45
CH-1501	2x.5H 100 MA	1.79
CH-188M	5 HY 200 MA	1.79
CH-488	10 HY .030A	1.39
CH-791	Dual 1.75-125 HY 100 MA	1.27

AUDIO XFMRS



AT501 HI-FI Special: PRI: 3000 ohms P-P/Sec 4/16/2.5Ω/200 ohms, 60-10,000 Cy. — 1 db. 50W as shown **$3.49**
AT152 HI-FI Driver Prt: 10,000 ohms. Sec: 40,000 ohms, PP Grids 50-15 KC (1 db. **$1.49**
AT863 Output to H.S. or line PRI 14,200 ohms, SEC: 8000, 600 ohms **$1.19**
AT449 HI-FI Driver (5000 ohms), to P-P output grids (4,000 ohms), 100-10,000 Cy. 10 W. 6V6 to PP 805's **$2.39**
AT666 Interoom Input: Spkr. (4-8 Ohms) to grid (250,000 ohms) **$4.95**
AT415 Plate (18,000 ohms C.T.) to line (125 ohms), 175 w — 500-600 Cy. **$1.95**
AT458 Plate (10,000 ohms C.T.), to line V.C. (500-125/30 ohms) HI-FI—50 W **$6.95**
AT070 Mike-or-Line (250 ohms) to grid (250,000 ohms C.T.) **$1.29**
AT795 Mike-or-Line (600 ohms) to grid (50,000 ohms C.T.) **$0.89**
AT-871 Universal Output—10W HI-FI **$1.49**
PR6 20,000 Ohms P-P/16,000 Ohms P-P also 5000/4000 ohms, Single End **$1.95**
SEC: 500/15.7/5/5/5/3.75/1.25 ohms. Response Flat P.M. 1 d.b. 30-20-kC Cycles **$4.75**
AT-694 HI-FI Output 3 Watts, 3K-16KC P.M. 1 db. 5500 Ohms P-P to V.C. (15 ohms) **$1.49**
AT4-A1: Mike (35 ohm Carbon) to line 600 ohm, 200 ohm **$1.19**
AT 649: Line (600 ohms) to Grid (75K ohms ..... .89
AT 448: Line (600 ohms) to V.C. (6 ohms) 17 db. Level **$1.19**
AT 631: Mike-or-Line (200 ohms) To Single or P-P Grids (50K Ohms) ..... .59
AT 718 Line (300 ohms) to Line (600/30 Ohm) Response 50-20KC ..... .49

All merchandise guaranteed. All prices F.O.B. N.Y.C. Send M.O. or Check. Only shipping charges sent C.O.D. Rated concerns send P. O.

COMMUNICATIONS EQUIPMENT CO.

131 Liberty St., New York, N. Y. Dept. N-3 Chas. Rosen Phone: Digby 9-4124

Successful TV Service Men

MUST Be Good *Business* Men

In operating a TV Service Shop, the technician finds himself called upon to be a business man—in charge of a complex, major operation. For this reason, SERVICE MANAGEMENT MAGAZINE places great emphasis on the vitally essential *business* fundamentals—including the knack of getting along with the public.

TV Service Demands Sound Management

To survive, to thrive, to make money, the TV Service Man needs a grasp of salesmanship, advertising, financing, accounting, stock purchasing. He must know how to hire and train the right kind of personnel. He must watch collections, carefully maintain his credit-rating. He should know how to apportion his available capital, how to get along with his banker.

Realizing that business skill is as important as technical talent, SERVICE MANAGEMENT MAGAZINE includes valuable articles monthly on business procedures.

Why not send for a sample copy? Or, better still, send $3.00 for a full year's subscription. Use the convenient coupon—*now*.

SERVICE MANAGEMENT
The Business Magazine of the Radio-Electronics Industry
161 Luckie St. Atlanta, Georgia

Service Management, 161 Luckie St.
Atlanta, Georgia

Enclosed find $3.00 for which enter a year's subscription.

Name .....

Address .....

City ..... State .....

portant factor in the business—volume of service work—is left purely to chance.

The second way is to add a sales and advertising touch to the business by contacting set retailers regularly to handle their service work and that of their customers. The business promotion through advertising is accomplished by maintaining a mailing list of set owners and sending them appropriate service business solicitation cards at regular intervals.

The cards that are supplied by the various tube manufacturers for direct-mail solicitation of service work are exceptionally good for this purpose. However, to accomplish the purpose for which they were intended it is necessary to carry out a continuing program by mailing the various cards in a series at regular intervals.

These personal contacts with set retailers and the use of a regular direct mail program represent aggressive selling tactics that are necessary to create business. However, they do take time.

The third method of operating a retail service business is the retail merchandiser's way of conducting a business. It is based on a survey of the maximum service business potential in a given area and the creation of a selling program that will bring in a substantial part of that service volume. Where a market is given that kind of a study it is entirely possible to develop sales campaigns that will bring in service business during those periods when radio and television repair business normally is slack.

In present TV areas the average television-equipped home also has a radio-phonograph combination and several table model and portable radios. In addition, the family automobile is usually radio equipped and there is probably a battery-operated portable or two stored away in a closet after the "B" batteries went dead. In the average home where there are three or more table model radios, surveys consistently show that at least two of them, while still operating after a fashion, could use some repair.

In other words, the average home in a TV area today has from five to ten pieces of equipment that should have regular maintenance and service attention. The well-equipped radio-television service shop has the equipment, the personnel, and the "know-how" to keep all of those radio-electronic devices in top operating condition.

The radio-television service businessman who is willing to stake out an area of one thousand television-equipped homes and develop a program designed to make his organization the maintenance company for keeping all radio, television, and other electronic products in those homes in good operating condition would entrench his business in that community so solidly that neither competition nor seasonal slumps would have any serious effect on his business at any time.

—30—

ACORN HAS A NEW LOOK



Welcome to our friends, far and near to visit and browse at our completely renovated shop, conveniently located in the heart of downtown New York. Whether you visit in person or shop by mail, you can be sure of prompt and courteous attention.

DUMONT 4-CIRCUIT INPUTUNER



Featuring FM BAND reception, as well as 13 TV channels. Fits into dual channel IF system Type 630 receivers without alteration. Higher gain 2-1 ratio on high channels, low noise, input impedance 300 ohms. 21.25 mcs. sound center IF. Continuous tuning. Complete with TUBES and KNOBS. Drastically reduced to..... $19.95

STANDARD Turret Type FRONT END $18.95



TYPE TV 201: 21.25 sound, for 630 chassis, etc.
TYPE TV 303: for all inter-carrier systems.

New Standard CASCO TUNER

Type 2027 for 630 TV Chassis, etc. Has greater sensitivity than any previous tuner. Uses 6BK7..... $22.89

CARTER DYNAMOTOR



BRAND NEW
Stock No. 403748
DC input 6VDC output 400 V @ 275 ma 6 v. DC. Perfect for mobile communications 10 cars, plane or boat. List price $71.40
NEW LOW PRICE $26.95

OIL-FILLED CONDENSERS
Made by Nationally Known Manufacturers
10 mfd, 600 V DC, 220 V AC...ea. 99c
Mounting Bracket 15c ea.
Write for Quantity Prices

OUNCER TRANSFORMER C-429

Push-pull primary 85 ohms DC resistance; secondary resistance 10 ohms and 20 ohms..... 99¢ each
3 for $2.75

G.E. 12" SPEAKER

12D1D-Alnico V Magnet-14.5 oz. Extended Range 50-15,000 cy. 25 watt..... $16.95

TERMS: 20% cash with order, balance C.O.D. unless rated. Prices F.O.B. our warehouse in N. Y. C. Minimum order $3. NOTE: Due to conditions beyond our control, prices are subject to change.

Phone WOrth 4-3270

ACORN ELECTRONICS CORP.
76 Vesey St., Dept. N-3, New York 7, N. Y.



RADIO ENGINEERING TELEVISION ELECTRONICS

Thorough training in all phases of radio and electronics, open to high school and junior college graduates. Old established school specializing in Radio training exclusively. Modern laboratories and courses. Enrollments limited. Approved veteran training.

VALPARAISO TECHNICAL INSTITUTE
Dept. RD Valparaiso, Ind.

International Short-Wave

(Continued from page 71)

sign-off. (Boice) Heard in New York as early as 1353 tune-in; signs off *without* playing "A Portuguesa;" seems to have news session in Portuguese 1420-1430 given by man and woman alternately; plays mostly classical music. (Beilington) A station believed CR6RN is noted on 9.635 with Portuguese music and announcements 1600; signs off 1630. CR6RD, *measured* 9.7047 at 1410, had musical program and heavy QRM. (Oskay, N. J.) This one noted recently with "mid-day" session 0630, good level in South Africa. A station noted on 7.764 probably is Silvo Porto; all-Portuguese programs noted through bad QRN 1515. (Ridgeway)

Argentina—LRX verified with a white card with LR1 on it in blue letters; listed LR1, 1070 kc., 50 kw.; LRX, 9.66, 7 kw., and LRX1, 6.120, 6 kw.; listed daily programs as "usually" 0530-2235. (Machwart, Mich.) LRT, 11.84, Tucuman, noted 1918 with North American recordings. LRS2, 9.320A, Buenos Aires, heard 2048 with music. (Winch, Calif.) LRS, 11.881, noted 1750 with good signal in England. (Catch) LRU, 15.29, noted signing off 1545, weak. (Niblack, Ind.)

Australia—*Radio Australia's* beam to Britain at 0245-0345 is carried over 9.580 and 11.760 (latter may be used for only part of this session); "Australian DX-ers Calling" on Sundays is now 0245 on both channels.

VLM4, 4.9175, Brisbane, noted 0340-0400 with music. (Eccles, Minn.)

Austria—Blue Danube Network, Salzburg, noted on approximately 6.06 at 0200; at 0300 was audible in parallel on 9.617 (old channel); noted another day 2255 with news and closing 1802 with "Star-Spangled Banner." (Pearce, England)

Azores—Ponta Delgada, 11.090, was noted recently (on a Sunday) signing off 1620; normal schedule in winter is 1500-1600. (Bishop, Ohio)

Bechuanaland—GDX-aren, Sweden, says ZNB, 8.230, Mafeking, is noted 1200-1400 and that news in *English* is relayed from Johannesburg, South Africa, during the first 10 minutes of the session, after which has music.

Belgium—Ruysselede is again using 17.946 in its "Calling Leopoldville" (Belgian Congo) session 1030-1130. (Ridgeway, South Africa)

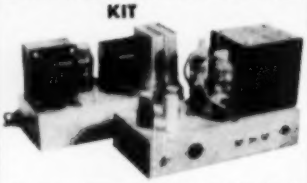
Brazil—A *new* Brazilian station is *Radio Poti* in Natal, state of Rio Grande do Norte, using 4.935 to 1930; QRA is Avenida Deodoro 245, Natal, Rio Grande do Norte, Brazil. ZYZ20, *Radio Relogio Federal*, 4.905, Rio de Janeiro, by this time should be on the air. *Radio Tupi*, Rio de Janeiro, is currently operating on m.w. 1280 kc. with 50 kw.; on FM and on TV; the m.w. and FM programs at 0400-2130 are relayed by ZYC9, *Radio Tamoio*, 15.37, listed 25 kw. but using only approximately 13 kw. Brazil is now on Summer Time (3 hours *ahead* of *EST*) but



HARVEY

Features the Finest Brands
At Most Reasonable Prices!

WILLIAMSON HR-15 AMPLIFIER KIT



The famous Williamson HR-15 amplifier circuit . . . now available with the original Partridge transformers built to Williamson's specifications. Build this kit in 3 hours or less, and enjoy sound of a quality you never heard before. The HR-15 is a 2-Chassis power amplifier for use with tuners or other front ends having own volume and tone controls. All American triodes, 2-6SN7GT, 2-807 or 6BG6G in PP output, 5V4G rectifier. Response ± .5 db, 10-100,000 cycles. Output impedances 1.7 to 109 ohms in 8 steps. Absolute gain 70.8 db. 20 db. of feedback around 4 stages and the output transformers. Kit is Complete with Tubes, Punched Chassis, Pre-wired Resistor Board, Sockets, Genuine Partridge Output Transformer, and All Necessary Parts $76.50

As Above, with CFB Transformer $90.00
PARTRIDGE Output Transformers available separately WWFB, as used in above kit $28.80
CFB Transformer, Hermetically sealed $40.00

HR-15T A Williamson Kit with all TRIAD TRANSFORMERS . . . including power transformer, chokes and specially designed output transformer which is completely sealed in tar. ± 2 db. 10-100,000 cps. Harmonic Distortion less than .1% — 10 watts output. Output impedances 4-8-16 ohms $69.50
Both HR-15 and HR-15T Kits available with KT-66 tubes for $3.00 extra.

★ ★ ★ ★ ★ ★

NEW RCA MASTER VOLTOHMYST



A measuring and test instrument that is unexcelled in its ability to cope with a large variety of electronic applications where direct readings of circuit performance must be made rapidly with a high degree of accuracy.

- ★ peak-to-peak values of unsymmetrical complex waves from 0.2 to 2,000 volts
- ★ Peak-to-peak values of symmetrical complex waves from 0.2 to 4,200 volts
- ★ rms values of sine waves from 0.1 to 1,500 volts
- ★ dc voltages from 0.02 to 1,500 volts
- ★ resistance over the range of 0.2 ohm to 1,000 megohms
- ★ small currents from 10 microamperes to 500 milliamperes, dc
- ★ large currents from 500 ma to 15 amperes, dc

Extra-size 8½ inch meter with expanded scales for quick, easy readability. A portable instrument . . . well suited to permanent or rack mounting in service shop, lab or factory.

WV-97A Complete with Direct Probe and cable, DC Probe, Ohms Probe and Cable, Positive Current Cable, Ground Cable.
Net $112.50

Accessory Probes available for measuring ac voltages at frequencies to 250mc . . . and for increasing dc voltage range to 50,000 and input resistance to 1,100 megohms.

NOTE: In view of the rapidly changing market conditions, all prices shown are subject to change without notice and are net, F.O.B., N.Y.C.

Telephone hrc LDisenberg 2-1500

HARVEY RADIO COMPANY, INC.

103 West 43rd St., New York 18, N. Y.

will return to Standard Time on March 31. (Serrano, Brazil)

PRA8, 6.015, Recife, noted 1659 with identification by man as "Radio Clube de Pernambuco"; continued with popular recordings to 1725. (Machwart, Mich.) PSL, 7.930, Rio de Janeiro, noted 1630-1700 with musical program. (Sutton, Ohio) ZYK2, 15.145, noted 1055 with usual Brazilian-type music and call of "Radio Jornal do Commercio;" QRM from YDC, Djakarta, Indonesia, 15.150. (Catch, England)

British Guiana—ZFY, 5.98A, opens weekdays 0443, Sundays 0543. (Bellington, N. Y.)

British New Guinea—VLT7, 7.280, Port Moresby, noted 0623-0700 at good level in Georgia. (Patterson)

Bulgaria—Radio Sofia, 7.672, noted in Portuguese 1330; at 1400 in another foreign language; still noted with *English* on 6.07 at 1600 with woman announcer. (Ridgeway, South Africa) The 6.07 channel is partly readable in Ohio during 1500 news session. (Sutton) The 9.705A channel noted with news 2000-2015 and 2300-2315 to North America; at other times evenings (*EST*) takes relays from *Radio Moscow*. (Saylor, Va.)

Burma—Burma Broadcasting Service. 28, Windemere Crescent, Rangoon, Burma, is reported widely with *English* 0915-1015 sign-off; woman announcer gives the next day's schedule at closedown. (ISWC, London) Has been heard in Sweden on 4.775 with news 1000; announces "This is the Burma Broadcasting Service calling from Rangoon." (*Nattuggian*, Sweden)

Canada—At sign-off recently, VED, Edmonton, Alberta, gave power as 5 kw., frequency as 7.320; said is on the air daily 17 hours (0900-0200); however, does run later than 0200 some days when has special relays or personal messages for listeners in the Northwest Territories. (Rosenauer, Calif.)

CBFY, 11.705, Montreal, noted opening 0700 with announcement for CBM, m.w., and CBFY, short-wave. (Ferguson, N. C.) Usually has religious service 0815.

Ceylon—Radio Ceylon, 15.120, noted recently 0815-0830 sign-off; bad QRM from *Radio Moscow* on same channel. (Catch, England) Noted on 11.975 mornings from 0830. (Niblack, Ind.) Heard on this frequency lately to 1145 sign-off. (Kelting, N. Y.)

Chile—CE622, 6.220, Santiago, noted 2323 with identification by man, then popular recordings. (Machwart, Mich.) CE920, 9.200A, Punta Arenas, heard 2130 and signing off 2200. (Sutton, Ohio) CE1180, 11.999A, Santiago, noted 1800. (Catch, England) CE1174, 11.740, Santiago, noted 1900-1930 with good signal; all-Spanish; announces "Santiago de Chile" and/or "Republica de Chile." (Niblack, Ind.)

China—When this was compiled, *Radio Peking* had moved from 10.360A to its old 10.260A channel.

ISWC, London, lists these "complete" schedules for *Radio Peking*, 3, Si-chang An Chieh, Peking, China—11.690, 15.060, at 1900 Amoy dialect, 1915 Chaochou, 1930 Siamese, 2000 Burmese; 6.100, 7.500, 10.260, 15.170, at 0300 Mongolian; 6.100, 10.260, at 0330-0400 Korean; 6.100, 10.260, 11.690, 15.060, 15.170, at 0400-0425 *English;* 11.690, 15.060, at 0430 Ke-chia dialect, 0500 Amoy, 0530 Indonesian, 0600 Japanese, 0630 Cantonese dialect; 6.100, 7.500, 9.040, 10.260, 11.690, 15.060, 15.170, at 0700-0730 Standard Chinese; 11.690, 15.060, at 0800 Vietnamese, 0830-0900 *English*, 0900 Siamese, 0930 Chaochou dialect, 1000 Burmese; 6.100, 10.260, 11.690, 15.060, at 1600-1630 Japanese; 6.100, 10.260, at 1630 Korean; 6.100, 10.260, 11.690, 15.060, 15.170, at 1700-1730 *English;* 11.690, 15.060, at 1730 Cantonese dialect, 1745 Ke-chia, 1800 Indonesia, 1830 Vietamese, 1900 closedown. POW messages recorded in Korea are given during the three *English* periods which begin 0400, 0830, 1700. *(I believe there are additional transmissions not listed above.*—KRB.)

A Chinese has been noted recently around 1800 on 9.026A; seems to have setting-up exercises 1815. (Stark, Texas) Also noted 1800-1845 fade-out by Foerster, Ill.

Colombia—HJCT, 6.201, noted to 2355 sign-off. (Leary, Ind.) HJCW, 4.945, Bogota, heard 2236-2313 sign-off; relays HJCO, m.w., according to announcement; identifies as "Emisoras Sur America" or "Transmitiendo para todo La America desde Bogota;" at sign-off man identifies in *English* and requests reports; anthem follows. HJKE, 4.834, Bogota, noted 2059 with identification by man as "Radio Continental," followed by native music. (Machwart, Mich.) Latter noted in Georgia 2221-2255; male announcer; all-Spanish. (Patterson, Ga.)

HJFB, 6.225, Manizales, noted with call 2000 and commercial announcement at 2014. (Catch, England) Bogota on 6.018 is noted with *English* announcement and sign-off 2330. (Niblack, Ind.) HJGF, 4.847, Bucaramanga, noted 2135-2202. (Patterson, Ga.)

Cyprus—ZJM8, 9.650, Limassol, is heard in Sweden 0655-0830. (*Nattuglan*, Sweden)

Denmark—OZF, 9.52, Copenhagen, noted 2130 and again 2250. (Lund, Iowa)

Dominican Republic—HI2A, 9.68, Santiago de los Caballeros, is heard regularly in South Africa from 1600 onwards; improves by 1615. (Ridgeway) HI8Z, 5.030, Santiago de los Caballeros, noted 1850-1920; all-Spanish. (Patterson, Ga.) HI4T, 5.970, noted opening 0600. (Glick, Ind.) HI1J, 6.025, San Pedro de Macoris, heard 2114 tune-in with native music; signed off 2116A; fair level and no QRM. (Bellington, N. Y.)

Ecuador—Quito, 4.928, noted with identification by man, followed by chimes and sign-off. HC4EB, 6.871, Manta, heard 2231 with identification of "Radio Manta," followed by native music. (Machwart, Mich.) HCJB, 17.890, noted strong but with QSB at 1215 in Spanish. (Kessel, Quebec)

NEW SPRING ITEMS AT LOWEST PRICES

RADIO STANDARD SURPLUS ELECTRONICS

HOTTEST ITEM FOR 1952

160-40 METER MOBILE RECEIVERS



MOBILE RECEIVER which will operate in your boat or car from 6 Volts D.C. and will cover the 160 METER BAND. Ship to Shore and Point to Point. Frequency Range 1600 KC to 2500 KC. Can be used on a fixed frequency only or by changing will cover the complete frequency range. Comes in 2 separate units, Receiver and Tuning Unit, 6 Volt Vibrator Power Supply Unit. The equipment is used, but is in excellent condition complete with tubes.

PRICE FOR COMPLETE UNIT WITH POWER SUPPLY **$24.95**

Separate Unit		
	RECEIVER	$22.50
	6 VOLT POWER SUPPLY	7.95

COAXIAL CABLE

52 OHM Transmission Cable Made to J.A.N. Specification, RG-8/U. Same as RG-8U. All unused, on Reels of approximately 1,000 Ft. Reels.

100 Ft.	9c per Ft.
1,000 Ft.	8c per Ft.
10,000 Ft.	7c per Ft.

ARC-4 TRANSCEIVER

100—156 MCS. Complete with all tubes and 12 Volt Dynamotor. For Planes or Mobile. 2 Meters, in excellent condition. **$39.95**

TELEGRAPH KEYS

J-48 Standard Hand Keys enclosed in box with cord and PL 55 Plug. All New ..... Ea. **$1.25**
J-5A Flameproof Key ..... Ea. $0.75



BRASS SELSYNS

Heavy Duty Bendix Selsyns. 110 volts 60 Cycles AC.

TYPE II—2 similar to type 6 Selsyns—New Cond. ..... Pr. **$30.00**

TG-5 CODE OSCILLATOR

Battery operated Code Practice Oscillator. Use singly for practice or can be used in pairs for practice or sending messages over wire between two points. Uses a 22½ volt dry cell battery and 2 flashlight cells. Contains keying relay and 1000 Cy. tone buzzer and head set. All brand new, with canvas carrying case ..... Ea. **$9.95**

RU 16 RECEIVERS

RU 16 RECEIVERS	$9.95 Ea.
Plug-in Coils for above Receivers, 9 Ranges 190-13570 KC	1.50 Ea.
BC 450 Transmitter	5.95 Ea.
Plug-in Coils for Transmitter, 2 MEG-9 MEG	1.50 Ea.
12 Volt Dynamotor for above, 330 Volt @ 170 MA	7.95 Ea.
RS-19 Control box	1.00 Ea.

REVERSIBLE MOTOR



1/40 H.P. Ball-bearing 3450 R.P.M. in Blast-proof case. Needs only a capacitor for starting. All Brand New. 110 V., 60 Cy. **$4.95**
Special Low Price
Starting Capacitor ..... $0.89 Ea.

ARC 5 EQUIPMENT:



TRANSMITTERS

3 to 4 MCS	$14.95
4 to 5.3 MCS	8.95
5.3 to 7 MCS	7.95

All above complete with all tubes and crystal. In excellent condition.

T-23 ARC-5 VHF TRANSMITTER—100-156 MCS
Chassis, Less Tubes and Crystals. Each **$12.95**

RECEIVERS

190 to 550 KC	$16.95
3 to 6 MCS	9.95
6 to 9 MCS	9.95

All above Receivers complete with all tubes and dynamotor. In excellent condition.

COMPONENTS

MOUNTING RACKS
Single ..... $1.00 Ea.
Double ..... 1.75 Ea.
Triple ..... 2.25 Ea.

RT ASSEMBLY & ANTENNA RELAY UNIT
Comes with Meter and 50 MMFD var. cond. for **$4.50**

BD-7 ARC-5 PUSH PULL MODULATOR UNIT
Comes w/tubes and dynamotor. Has cond. **$11.50**

R-4 ARR-2 RECEIVER—234-258 MCS
Complete with all tubes and dynamotor. Excellent condition. **$19.95**

SCR-522 TRANSCEIVER

100-156 MCS—HOTTEST 2 METER BUY OF THE YEAR. VHF MOBILE or FIXED. Complete with all Tubes and 24 Volt Supply. Excellent Cond. **$42.50**

CAPACITORS • FIXED • OIL FILLED

Solar, Pyranol, C.D., Etc.
ALL D.C. VOLTAGE RATINGS

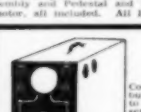
2	MFD.	400 V.	$0.79	4 MFD. 1000 V.	$1.75
3X3	MFD.	400 V.	1.95	8 MFD. 1000 V.	3.95
10	MFD.	400 V.	2.95	10 MFD. 1000 V.	4.95
1	MFD.	600 V.	.75	1 MFD. 1500 V.	1.50
4	MFD.	600 V.	1.95	4 MFD. 1500 V.	2.25
5	MFD.	600 V.	1.95	6 MFD. 1500 V.	2.95
6	MFD.	600 V.	1.95	1 MFD. 2000 V.	1.95
7	MFD.	600 V.	1.95	2 MFD. 2000 V.	1.95
8	MFD.	600 V.	1.95	3 MFD. 2000 V.	3.50
10	MFD.	600 V.	2.25	4 MFD. 2000 V.	3.95
15	MFD.	600 V.	2.95	1 MFD. 3000 V.	3.95
20	MFD.	600 V.	2.95	1 MFD. 5000 V.	3.95
1	MFD.	1000 V.	1.00	2 MFD. 5000 V.	5.95
2	MFD.	1000 V.	1.25	1 MFD. 5000 V.	5.95

CAPACITORS TRANSMITTING VARIABLE

K 1 MMFD. to 75 MMFD. ¼" Spacing **$1.95**
*D 12 MMFD. to 25 MMFD. 3000 V. Peak 1.00
L 28 MMFD. to 110 MMFD. 5000 V. Peak 2.95
*F 10 MMFD. to 150 MMFD. 5000 V. Peak 3.50
A 2 MMFD. to 80 MMFD. 1500 V. Peak 1.00
*With National Vernier Dial.
All New Hammerlund, Cardwell, Etc.

RADIO DIRECTION FINDER

MODEL DF-2, tunes from 15-70 KC and 100-1750 KC. Complete Radio Direction Finder Unit ready for installation and operation on 28 Volts D.C. Receiver Loop Assembly and Pedestal and 28 Volt Dynamotor, all included. All Brand New ..... **$95.00** Set



3" TRIUMPH OSCILLOGRAPH

Complete Test Scope, with built-in Wobulator so as to be used on TV or FM servicing. Operates from 110 V. 60 Cy. A.C. Limited Supply. All these units have been carefully checked and are in excellent condition. A Real Buy. SPECIAL **$34.95** Ea.

PE 110 POWER SUPPLY

This unit was used as part of BC669 transmitter. Input 110 volts 60 watts. Output 540 volt @ 455 ma. for transmitter plate and low voltage supply for Receiver and Filaments. Uses 4-5Z3 tubes for high voltage and 1-80 tube for low voltage. Also contains a 12 volt Vibrator pack for Receiver voltages. This supply is well filtered and regulated and is ideal for **$34.95**
your Ham transmitter. Low priced at

FL-8 FILTER



Range or Tune for 1020 cycles Audio. Switch mounted on Filter. Excellent for C.W. Ea. **$1.25**

WALKIE TALKIE BATTERIES

BA 37—1½ vc-A	$0.80
BA 38—103½—B	1.25
Both for	1.90

12 VOLT STORAGE BATTERY

Aircraft Type, 12 Volt, 34 Amp. HR. Made by Exide. Completely inclosed with removable top. Dry Charged. All Brand New **$14.95**



PROP PITCH MOTORS

For your Beam Antenna: 20 Volt to 32 Volt, A.C. or D.C. ⅓ H.P. Motor 1½ RPM Gear Reduction, 7000 to 1.
ALL BRAND NEW **$13.95**

¼ H.P. PROP PITCH MOTORS (Small Size)
20 to 32 Volt A.C. or D.C. Gear Ratio 9000 to 1. All Brand New **$16.95**

GYRO MOTOR UNITS

Dual gyro unit. Both gyro motors mounted on single base. Wired in parallel for 12 or 24 volts. Excellent condition. Please specify if you wish the 12 or 24 volt. ..... Set **$4.95**

MISCELLANEOUS SPECIALS

9 Channel Push Button Switch, spring-back type	$1.00
300 OHM Twin Lead	.04 per Ft.
671g Volt Radio "B" Batt.	1.00 Ea.
1 Lb. Roll Rosin Core Solder	.95 Roll
BC609G Interphone Switch Box	.59 Ea.
RG 7U COAX 95 OHM	.06 per Ft.
RG 59U COAX 52 OHM	.06 per Ft.

DYNAMOTORS

DM-19-C., 12 Volt DC. Input 16 Amps. Output 500 V. at 200 MA. Cont., 300 V. at 400 MA. Int. Ea. **$19.95**

BC 456 MODULATION UNIT

Part of SCR274N. Equipment contains Relays, Transformers and 1245, 1625 and VR. 150 (OD3 Tubes.

Less Tubes	$1.50
With Tubes	2.95



MODEL 66-S TRANSMITTER

All brand New. 100 Watts CW. or MCW. emission. Operates from 110 V., 800 Cycle, easily converted to 60 Cycle operation. Low frequency range, 300 KC. to 600 KC. High frequency 3,000 KC. to 18,000 KC. using an E.C.O. We furnish complete conversion data with each transmitter. Complete with tubes and schematics. **$59.95**

BC 375 TUNING UNITS FREQUENCY RANGES AVAILABLE

200 KC-300 KC, 1500 KC-3000 KC, 3000 KC-4500 KC, 4500 KC-6250 KC, 6200 KC-7700 KC, 7700 KC-10000 KC, 10000 KC-12500 KC. With Vernier Dial and many parts which alone are worth 3 times our Low Price of ..... **$2.95** per unit

SOUND POWERED HAND SETS

TS-10 type—Various manufacturers. No batteries needed for operation. Use in pairs with wire. Audible up to 10 miles. Ideal for TV antenna installation, etc. Excellent condition. ..... Pair **$17.95**

SOUND POWERED HEAD AND CHEST SET

Use same way as Hand Set except you have freedom of hands. No Batteries or power source required for operation. Excellent Condition **$11.95**

2 VOLT VIBRATORS

VIBRA Synchronous Type. Used in all portable radios having 2 Volt wet cell supply. All new. Ea. **$1.50**

TANK PERISCOPES

Type M9 Contains 2 glass prisms, one at each end of the periscope. Use them for looking over crowds, at parades, ball games, races, etc., or use prisms separately for optical work. Low priced. All Brand New **$1.98**



BC-1206 BEACON RECEIVERS

Manufactured by Detrola Radio. 200 to 500 KC. For Direction Finder. Contains 2—2516, 1—6SA7, 1—6SF7, 1—6SK7, 1—6K7. Excellent condition. Complete. **$7.95**

MIDGET SELSYNS

AY6 type operates from 6-12 Volts 60 Cycl. Use as both transmitter and receiver. These compact little units draw almost no current and work fine for all remote position indicating applications. OD 1¼x2¼x2". Has spring return shaft. All New (Appx. wt. 1 lb.) ..... Each **$2.50**
AY-1 Type or AY-5 Type, same as above but has a continuous rotating shaft. These compact units are all new **$4.95**

G.P.7 TUNING UNITS



5 Ranges: A-350-800 KC., B-800-1200 KC., D-3000-4350 KC., E-4325-6000 KC., F-6200-9050 KC. Also contains Capacitors, Resistors, Vernier Dials and many other parts. A REAL BUY while they last. Each unit range **$4.95**

DU-1 MANUAL DIRECTION FINDERS

Tunes to broadcast, lighthouse and beacon stations—easy to master for use on marine bands. True bearing immediately. For use with any loop input receiver. Complete with 6 tube 2 tube pre-amplifier. Used, good condition.
Specify 12 V. D.C. or 24 V. D.C.
Excellent condition. Each **$19.95**

TUBES

807S	$4.95	6F8	$1.00
2P2T	1.95	6N7	1.00
5U4	1.25	6Q5G	2.95
5U4	12.50	6S17	1.00
6SJ7	1.00	6V6G	1.25
12SH7	.90	6X5	.75
6AG5	1.00	6B8	.75
6AK5	1.50	6C4	.75
6AC7	1.00	83V	1.25
4E27	12.95	6SH7	.90
3E29	8.95	7H3	.90
VR90	1.00	6SN7	.90

304TL **$7.95**

TAPE

CANNED FRICTION TAPE, ½", 831½ Ft., 6 Rolls to Can ..... $1.25 per Can

TAPE IN INDIVIDUAL BOXES
RUBBER TAPE, ½", 15 Ft., 15c Roll. SCOTCH TAPE, ½", 90 Yds., 39c Can. FRICTION TAPE, ½", 831½ Ft., 15c Roll. MICA TAPE ..... 25c Roll

All Mail Orders Promptly Filled. F.O.B. San Francisco . . . All California Orders—Add 3% Sales Tax . . . Do not send postage stamps. Write for our new 1952 free booklet listing our stock and prices on Radio, Electronic, Tools, Hardware, Meters, Wire, Motors, Batteries, Aluminum Sheets, etc. 20% Dep. on all C.O.D. orders. All items sold, subject to prior sale, and prices subject to change without notice.

STANDARD SURPLUS

1230 Market St., San Francisco 3, Cal.
Telephone HEmlock 1-3106

YOU GET REAL VALUE FROM
PLATT ELECTRONICS

SENSATIONAL SAVING!
DYNAMOTOR
For DY-12 Power Supply for ART-13
NOW ONLY $24.95 complete

SCR-27N
COMMAND and
ARC-5 Equipment

RECEIVERS

	Used	New
BC-453—190 to 550 KC	$22.95	$42.50
BC-454—3 to 6 Mc	11.95	18.95
BC-455—6 to 9 Mc	11.95	18.95

TRANSMITTERS

BC-457—4 to 5.3 Mc	12.95	21.95
BC-458—5.3 to 7 Mc	12.95	21.95
BC-696—3 to 4 Mc	16.95	29.95
BC-459—7 to 9.1 Mc	16.95	27.50

ADDITIONAL EQUIPMENT

BC-456 Modulator	3.95
BC-450 Control Box (1 Receiver)	1.49
BC-451 Control Box (Transmitter	1.29
BC-442 Relay Unit (ANT.	2.95
Plugs, PL-147, 148, 131, 132, 133, 134, 136—EACH	1.25
Flexible Shafting with gear to fit Receiver	1.00
1 Receiver Rack	2.25
1 Transmitter Rack	1.00

BC-221 Frequency Meter
Real Value! QUANTITY IS LIMITED—so first come, first served. They are just like new, with original calibration charts. Range 125-20,000 KC with crystal check points in all ranges. Complete with crystal and tubes.
$119.50

TIME CLOCKS
12 and 24 hour cycle timing. Unlimited uses. Needs minor repairs. AN EXCELLENT BUY—HOW CAN YOU GO WRONG!
ONLY $9.95

25 POUNDS ASSORTED RADIO PARTS
A TERRIFIC BUY AT ONLY $2.79

HEADSETS
HS-33 low impedance with cord and plug, used, fine condition $3.29
HS-33 high impedance, BRAND NEW with ear pads 4.25
HS-33 low impedance, BRAND NEW with ear pads, cord and PL-54 plug 4.95
HS-30 with ear plugs, low impedance, used, good condition 1.69
CD-307A Cords, 6 ft. NEW 89
H-16/U high impedance. Includes two receiving units $3.95

VHF Excellently Reconditioned Guaranteed
SCR-522
AIRBORNE COMMAND EQUIPMENT
Frequency Range 100 to 156 mcs. in 4 channels receiver and transmitter. Crystal controlled. Complete equipment. Consists of trans rec, control box BC-602, dynamotor PE-94, AN104A antenna, plugs, etc. Power input with PE-94 is 28 v.
Electrically Tested—Complete as Shown. Only $129.50
BRAND NEW—PRICES ON REQUEST

NOW! Fill Your Battery Only Twice a Year
with Automatic Battery Filler
Made by leading U.S. Battery Mfr. Doubles battery life, very low cost. Simple care prevents battery break-down. Fits all cars. Instantly installed.
ONLY $1.95 COMPLETE

DUAL PURPOSE EMERGENCY UNIT
• Fire Extinguisher
• Tire Inflator
Made by leading British Auto Mfr. Especially recommended for oil gas and electrical fires. Guaranteed by mfr. against defects. Order 1 now for your home, one for your car in case of fire.
Rate of Fire
ONLY 2.29 each

MINIMUM ORDER $2.00
Immediate Delivery. Send 25% deposit on C.O.D. orders. All shipments F.O.B. N.Y.C. (N.Y.C. residents add sales tax to your remittance.)

PLATT ELECTRONICS CORP.
Dept. A, 489 Broome St., N. Y. 13, N. Y.
PHONES: WO 4-0827 and WO 4-0828

HC1AC, Quito, "La Voz de la Democracia," noted on 6.210 signing on 0640; news in Spanish 0645; fair level in Calif. (Rosenauer)

Egypt—Cairo, 9.555A, noted from 1443 tune-in to 1611 sign-off with march, probably anthem; had news 1601-1605 by man; French news 1530; at 1545 played some popular American recordings. (Bellington, N. Y.) This one noted in England 1430 with *English;* signs on 1345; has news in French 1400. (Pearce)

France—Paris, 7.24, noted 0311 with "The French Have a Word For It;" fair to good level, sometimes excellent. (Winch, Calif.) Paris heard on 9.560 at 2006 with news in French to 2029 when signed with "La Marseillaise" and signature of notes played on oboe. (Niblack, Ind.) Heard on 9.68 in Czech 1445 and in Arabic on 9.755; at 1500 the 9.68 channel gave call in French followed by news in that language; also noted signing on again on this channel 1730 (in French). (Pearce, England)

Paris, 17.85, noted 1115 sign-on to *after* 1230. (Bishop, Ohio) Heard on 9.966A at 1628-1646 with severe CWQRM; used French and Portuguese; signed off 1646. (Patterson, Ga.) Noted relaying *United Nations Radio* on 9.755 at 1430. (Golden, Mass.) Heard parallel on 9.56 and 11.915 with Arabic around 1230; closed 1300. (Bellington, N. Y.)

Germany—Hamburg's "Nordwestdeutscher Rundfunk" is now operating on 7.290, 11.795, 15.275, 17.815, 17.845, Sundays 0000-1900, Sundays 2300-2200; Tuesdays 0000-1900; Tuesdays 2300-1900; Wednesday and Thursdays 2300-1900; Fridays 2300-2000 (*EST*). (ISWC, London) Heard on 7.29 with news in German 0700 in parallel with 11.795. (Pearce, England)

AFN, 5.470, Giessen, noted 1745 with poor level and much QRM. (Catch, England) Heard 1445 with songs and 1500 with news. (Pearce, England) RIAS, 6.005, Berlin, noted with religious program 0255 recently, followed by orchestral music; at 1800 with news in German. (Pearce, England)

(*Continued on page* 141)

EMPIRE STATE BUILDING MULTIPLE TV TOWER COMPLETED

The world's first multiple transmission center for commercial use, is now in operation with the completion of the Empire State Building Multiple Television Tower.

Seventeen months' time and one-hundred thousand manhours went into the construction of the new tower. Five broadcasters are now on the air with better signals as a result of this new installation.

Thirteen high power, high frequency transmitters, including three FM, five TV picture, and five TV sound, are now radiating signals simultaneously from the 222 foot steel structure atop the world's tallest building without the slightest interference.

The cost of the project has been estimated at about $875,000 of which approximately $560,000 was the cost to the Empire State Building for erecting the steel structure, and $315,000 the cost to Empire State and the five broadcasters for electronic development. In addition, each broadcaster spent about $400,000 for installing transmitters and lines.

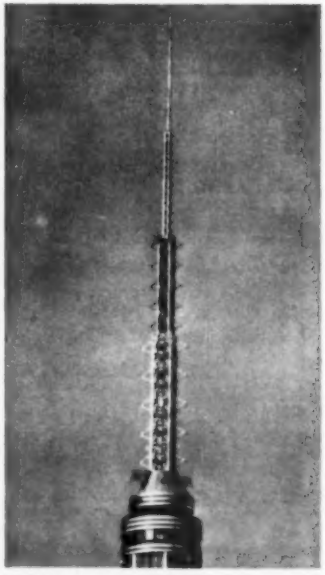
From an average service radius of 38 miles before the Empire State project, the TV broadcasters now reach a radius of about 70 miles, an area with an estimated audience of 17 million people. The extended coverage is due to a combination of the increased height afforded by transmission from Empire State and increased power permitted by the FCC.

On the tower are eight separate antenna systems, 116 radiating elements or dipoles, feed cables, transmission lines, transformers, and junction boxes. More than 60 pipes, coaxial lines, and conduits go up into the base of the tower.

The basic tower, which weighs about 60 tons, was designed to withstand wind velocity up to 150 miles per hour. Two special Pyrex bulb beacon lights were developed for the top of the tower by General Electric when ordinary lamps kept shattering. After a year of use, a lightning rod which tops the tower is already pitted in more than a hundred places where the lightning bolts have landed.

The five stations transmitting from this tower include WJZ-TV (Channel 7), WCBS-TV (Channel 2), WABD (Channel 5), WNBT (Channel 4), and WPIX (Channel 11). Station WATV (Channel 13) may also transfer to the Empire State Building during 1952. —30—

Close-up view of the multiple television transmitting tower atop the Empire State Building in New York. Five TV stations are using these facilities at the present.



Indoor Antennas

(Continued from page 42)

various sections of the room until a good location for it is found. Once a suitable spot is located, the housewife is restricted in the arrangement of her furniture thereafter. A person moving about in the room or a change in position of a metallic or electrical obstacle in the room can alter the relative relation between direct and reflected signals and influence effective signal strength at the receiver input. In one location it was found that the position of the telephone on a table-top adjacent to a TV receiver with a built-in antenna had a very great influence on the quality of a high-band station.

When there is a somewhat greater delay between direct and a preponderance of the reflected signals (fractional part of a microsecond), picture smear results. This is caused by close picture displacement between direct and reflected components on the tube screen. Smear also results when certain sideband frequency bands in the 4 mc. video span reach the receiver at stronger relative levels than others. Additive and subtractive relations between sideband components can be such that direct and reflected signals add for some sideband components and cancel for others. We anticipate this relation when we consider that picture and sound are not always minimum at the same angle of departure from the correct antenna orientation.

A third defect occurs when a preponderance of the reflected signals reach a comparable signal level as a direct signal and/or are delayed an appreciable time with respect to the direct signal. Usually, an unstable raster occurs because of poor sync stability. Continuous shifting of sync control between the various signal components (direct and reflected) sets up a number of pictures displaced with respect to each other. Appearance (except for instability) can be likened to reception of a number of ghosts from a range of hills.

It is apparent that reflection and orientation defects make it difficult to obtain optimum orientation for each channel when stations are in different directions. Difficulties can be encountered at many sites when stations are all in the same direction. At some indoor locations and on certain channels, peak results are often obtained when the antenna is not oriented in the direction of a station.

Signal Levels and Noise

The indoor antenna must function under very trying conditions. An indoor location means a low signal level; a *low* indoor location means a still weaker signal. The antenna, therefore, has a weaker signal to work with and is nearer to sources of noise and interference. Thus, signal-to-noise ratio is substantially poorer. Insofar as im-

world's toughest transformers

CHICAGO "SEALED-IN-STEEL" New Equipment Line



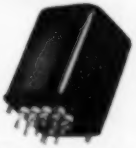
Preferred!

the INSIDE STORY tells why!

The proof of toughness is on the *inside*—the actual proof that demonstrates why CHICAGO Transformers are preferred by engineers, why they fully meet the express requirements of today's tubes and circuits. Here are the "inside facts" of CHICAGO "Sealed-in-Steel" design:

1. Exclusive one-piece drawn-steel case, unsurpassed for strength, moisture-resistance, better electrostatic and magnetic shielding, mounting ease, and streamlined appearance.
2. Uniformly-wound precise coil structures—cooler operation and better electrostatic shielding in power units—minimum leakage, optimum coupling in audio units.
3. Core of high-grade non-aging silicon steel brought to high efficiency by scientific heat-treating in CHICAGO'S own annealing ovens.
4. Core and coil vacuum-impregnated with varnish. Final high-temperature baking achieves a perfectly impregnated coil and core locked against vibration.
5. All internal free space is filled by special, moisture-resistant compound. Prevents corrosion and helps maintain far cooler operation than in conventional air-surrounded mountings.
6. Checked by quality controls at every stage of manufacture, rigidly inspected, "torture-chamber"-tested to insure long, dependable life in actual service.

AVAILABLE IN THREE VERSATILE CONSTRUCTIONS



H-Type. Steel base cover deep-seal soldered into case. Terminals hermetically sealed. Ceramic bushings. Stud-mounted unit. *Meets MIL-T-27 Specifications.*



S-Type. Steel base cover fitted with phenolic terminal board. Convenient numbered solder lug terminals. Flange-mounted unit.



C-Type. With 10" color-coded stripped and tinned leads brought out through fibre board base cover. Flange-mounted unit.



SEND FOR "NEW EQUIPMENT LINE" CATALOG

You'll want the full details on CHICAGO'S New Equipment Line—the famous Sealed-in-Steel line that offers advanced engineering design to fit today's circuits. Lists units for all purposes: Power, Bias, Filament, Filter Reactor, Audio, MIL-T-27, Modulation, Stepdown and Isolation. Write for your FREE catalog today—or get a copy from your distributor.

CHICAGO TRANSFORMER

DIVISION OF ESSEX WIRE CORPORATION

3501 ADDISON STREET • CHICAGO 18, ILLINOIS

ANOTHER Editors and Engineers PUBLICATION

RADIOTELEPHONE LICENSE MANUAL

RADIOTELEPHONE OPERATOR'S QUESTIONS AND ANSWERS STUDY GUIDE

GET YOUR COMMERCIAL RADIOTELEPHONE LICENSE

WITH THIS BRAND NEW BOOK

Now in one convenient volume, everything you need to obtain your license. Contains the following elements:

ELEMENT I:
Questions On Basic Law

ELEMENT II:
Basic Operating Practice

ELEMENT III:
Basic Radiotelephone

ELEMENT IV:
Advanced Radiotelephone

$3.75 FROM YOUR DISTRIBUTOR

ADD 10% ON DIRECT MAIL ORDERS TO

EDITORS AND ENGINEERS, LTD. 1302 KENWOOD ROAD, SANTA BARBARA, CALIF.

Distributed also from BAKER AND TAYLOR CO. Hillside, New Jersey

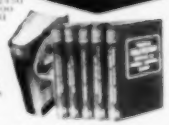


FREE! Just For Examining COYNE'S New 6-Volume Set APPLIED PRACTICAL RADIO-TELEVISION

Get This New Book FREE—Use Radio-Television Picture Patterns and Diagrams Explained. Gives wiring details and diagrams on latest Radio and Television sets. Also set of TV Test Patterns and trouble shooting short cuts. A must in every serviceman's kit. It's yours FREE!

Helps You Get Ahead!

This book is our gift to you for examining Coyne's brand new 6-volume set, APPLIED PRACTICAL RADIO-TELEVISION. Here is the most up-to-date set of reference books in America! 2,000 easy-to-understand pages, 1,200 illustrations. Covers all phases of radio and television. Tells you how to install, service, adjust, trouble-shoot, align all types of radio and television sets. "Break-down" photos help you understand quicker. Set includes new 782 page book reference Cyclopedia of Television Servicing.



Sensational Free Book Offer — Send No Money!

Mail coupon now to get this great new reference set and the FREE Book of Radio-TV Diagrams and Test Patterns. Use the set 7 days. If you keep the set, pay just $5.00 after 7 days and $3.00 a month until $23.00 plus postage is paid. Cash in price $20.00. If not 100% satisfied with set send it back and you owe nothing. EITHER WAY THE BOOK ON TV PICTURE PATTERNS AND DIAGRAMS IS YOURS FREE. Coupon is limited. ACT NOW!

FREE OR 7 DAYS TRIAL

MAIL COUPON NOW!

COYNE ELECTRICAL & TELEVISION-RADIO SCHOOL
500 S. Paulina St., Dept. 32-T3, Chicago 12, Ill.

Rush "APPLIED PRACTICAL RADIO-TELEVISION" on 7 days' FREE TRIAL, per offer above. Include FREE Book.

NAME ..... Age .....

Address .....

City ..... Zone ..... State .....

Where Employed .....

Check here if you want set sent C.O.D. You pay postman $23.00 plus C.O.D. postage. Same money-back guarantee of satisfaction.



MANUFACTURERS! EXPORTERS! PURCHASING AGENTS!
•HONESTY•INTEGRITY
•QUALITY OF PRODUCT

- Radio and Receiving Tubes
- Transmitting & Special Purpose Tubes
- Radio and Electronics Parts and Equipment
- All Types of Electrical Wire, Magnet Wire, and Cable

Write — Wire — Phone For Your Special Needs

We are also bonafide General Purchasing Agents. CAN WE HELP YOU? References: Dun & Bradstreet.

Electronic Expediters

225 N. Wabash Ave., Dept. R, Chicago 1, Ill.
Phone ANdover 3-0841

BRANCH OFFICES
9015 Wilshire Blvd., Beverly Hills, Cal., CR 4-8237
507 5th Ave., New York 17, New York, MU 7-[illegible]

pulse interference is concerned, the weaker signal means the receiver is made more subject to sync instability from car ignition and electrical appliance noises.

A trying defect of receivers with indoor antennas in certain television areas is local oscillator interference. Again the defect is pronounced because of a weaker signal and the location of the antenna nearer to offending receivers in neighborhood. This defect is prevalent in areas assigned the following channels: 2—5, 3—6, 7—11, 8—12, or 9—13.

Often the indoor signal levels are so poor that snow or salt-and-pepper effect is apparent. This condition destroys the resolution and clarity of the picture and is extremely annoying to a person accustomed to a clear, well-defined picture. This is a very obvious defect. However, the picture often is afflicted with a more obscure trouble resulting from a less serious loss in signal level and/or improper antenna orientation. Noise components in the video signal cause a constant wiggling in the background of the picture. This motion, however slight, has an apparent effect on the picture quality. It is often not so severe that a person will criticize the picture and often it goes unrecognized. Rather it is a type of subtle defect that when it is not present and picture background is rigid and steady, a person is likely to remark "That is the best picture I've ever seen," or "It's just like a movie." Proper orientation and peak signal-to-noise permit this type of picture.

Not only is attainment of a high signal-to-noise ratio hampered by orientation, weak signal level, and proximity of noise sources, but space limitations prevent use of directional parasitic elements and often dipole elements cannot be fully extended to intercept a half-wavelength on the low band. Consequently, it is difficult to obtain a steady, clear, motionless-background picture.

Inconvenience

Many indoor antennas are inconvenient—even to the extent that some families pass over certain channels because elements must be changed or the antenna moved. For example, in one home, the antenna is moved from the top of the TV set to the top of the piano when a specific channel is to be received.

The indoor antenna is not an appealing article of furniture. When extended it is annoying and can be a hazard. It limits living room styling if there are bad reception areas in the room.

Idealized Indoor Antenna

The ideal indoor antenna would permit optimum signal-to-noise conditions from each station in accordance with its energy level. It would attain this objective with as little inconvenience as possible.

What factors, then, contribute to good indoor antenna performance?

FAIR RADIO SALES

132 SOUTH MAIN ST
LIMA, OHIO



Television Accessories:

Universal flat and peak roof mount made of heavy gauge steel, aluminum finish. Adjustable flaps provide easy means for mounting on any peak regardless of roof pitch. Swivel mast holder takes up to 1¼" pipe and can be raised easily.

PRICES: Each: $1.69. Box of 12: $17.50

		Each	Box of 12
GUY CLAMPS up to 1¼" Pipe	23c	$2.40
GUY RINGS—1¼" Pipe	15c	1.49

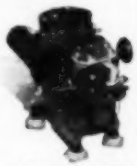
TURNBUCKLES:

Dia.	Total L.	Open L.	Closed L.	Ea.	Doz.
¼	5"	2⅜"	3⅛"	10c	$1.65
⅜	6¾"	2¾"	4⅛"	20c	2.10

HOOKS: 2187 ⅜" x 5" Galvanized. 6c Each; Box of 24 $1.30

AIRCRAFT CABLE: ⅛" x 7 x 7 strands, Weather proofed, 47 Foot Lengths only at ..... 75c Ea.
GUY CABLE CLAMPS: ⅛" 10c Ea. Box of 25 $2.25

DELCO GASOLINE ENGINE GENERATOR



12 Volt DC 750 Watt generator driven by a one cylinder four cycle air cooled gasoline engine, approx. 2 HP, with self starter, output meter, and on off switch. Rope or electric start. Gov't surplus, reconditioned **$79.50**

HRU-2B Homelite Gasoline Engine Generator, 28 VDC 2000 Watt output. Used, Tested **$89.50**

ANTENNA EQUIPMENT



MAST BASE—INSULATED

MP-132 BASE—as Illustrated at left. 1" heavy coil spring. 2" Insulator. Overall length: 11½". Weight: 2¾ lbs. Price **$3.95**

MAST SECTIONS FOR ABOVE BASE Tubular steel, copper coated, painted, in 3 foot sections, screw in type. MS-53 can be used to make any length, with MS-52-51-50-49 for taper. Price for any section ..... **50c Ea.**

AN-194A Antenna—100-156 MC	$2.00
AN-117 Whip Steel—6 Ft. length	1.50
AN-109A Whip Steel, 5 Ft. w/Base	1.50
AS-27/ARN-5 Ram's Horn, 110 MC—USED	5.95
LP-21-A Loop for ADF equip—Used, tested	9.95
AT-37/APT Stub—112-150 MC	6.95
AT-42/APT-3 or APT-1 Stub—112-150 MC	6.95
AS-37/ARQ-8 Spike with coaxial load in base	4.95
AS-61/ARN-5-Half Wave Dipole—335 MC	3.95

AERIAL WIRE

Aerial Wire—Phosphorous Bronze #16 Stranded, 200 lb. test. Weather-proof. 150 feet on Reel. RL-3 with Clips	$1.50

WIRE—HEAVY DUTY RUBBER COVERED

2/#16—20 Ft. Length	$1.25
2/#12—10 Ft. Length	1.00
1/#6—Shielded, 15 Ft.	1.50
1/#6—Shielded, 7½ Ft.	.75
1/#2—Shielded, 8 Ft.	1.00
1/#8—Rubber covered—Per Foot	.06
1/#14—Shielded, Rubber Covered, 50 Ft. Length	$2.75
Or Per Foot, at	.06

INVERTERS:

NUMBER:	INPUT:	OUTPUT:	PRICE:
5-D21-S23A	27 VDC 35Amp	115 V—400 cycle 1 Ph. 485 VA. USED:	$14.95
		NEW:	24.95
PE-118	26 VDC 100Amp	115 V—400 cycle 1 Ph. 1500 VA. USED:	$19.95
PE-218	28 VDC 92Amp	115 V—400 cycle 1 Ph. 1530 VA. USED:	$19.95
PE-115	28 VDC 36Amp	80 V—800 cycle 1 Ph. 750 VA. USED:	$9.95
		NEW:	14.95
PE-206A	27.5 VDC 38Amp	80 V—800 cycle 1 Ph. 750 VA	Less Case
MG-153F	24 VDC	115 V—400 cycle 1 Ph. 750 VA 26 V—400 cycle 1 Ph. 250 VA. USED:	$69.50
MG-Type A-1 200 V—400 cy 3 Ph.		200 V—400 cycle 3 Ph. 30 VDC 200 A. NEW:	$69.50
CM-93 Alt.	6000 RPM output 30 KW	120-208 3 Ph. 400 cycle	$69.50

MISCELLANEOUS:

24 VDC Circuit Breaker—30 Amp—Heinemann	$1.50
125 VAC Circuit Breaker—12 Amp—Heinemann	2.95
FL-8 Audio Filter—1620 cycle—Used	1.50
Leg and Seat Assy. for Hand Generator	3.50

TRANSMITTERS:

BC-220 with Tubes	$ 4.95
TA-12B Transmitter, with Tubes—USED	29.95
T-20 ARC-5, BC-457—4 to 5.5 MC—NEW	14.95
BC-459 Transmitter—7 to 9 MC	29.95
274N—As is—No Tubes—No Returns—BC-457 or 458	3.95
BC-375 Trans.—As is—No Tubes—No Meters—No Returns	10.00

RECEIVERS:

R-1/ARR-1 for conversion to 220 MC	$ 4.95
RA-10 Receiver with Tubes & Dyn.—USED	24.95
BC-455 Receiver—7 to 9.1 MC	7.95
274N—As is—No Tubes—No Returns—BC-453	8.00
BC-454 or 455	3.95

CORDS—CABLES

CD-501 Cord: 1-GN-45 Generator	$2.00
CD-318 Cord w/PL-68 & SW-141 & AK-407 T Throat or Lip Mic.	.80
CD-307 Cord—6.5 Ft. w/PL-55 & AK-20	.80
CD-604 Cord w/C-410 Trans. & PL-54 Plug	.89
BC-375 or 191 Cable w/PL-64, 61, or 59 each end	2.50
CD-505 Cord for LP-21 Loop	1.75
MC-215 Tuning Shaft for 274N	2.00

CONTROL BOXES:

	NEW:	USED:
C-87/ART-13—f/ART-13 Trans.	$ 6.95	$4.95
MB-5C Control Box f/RA-10 Rec. w/Mtg.	12.95	
BC-434 for ADF	6.95	3.95
BC-732 for Lavalier	2.95	1.95
BC-646 Control Box f/BC-645	2.00	
BC-461 Reel Control Box w/Counter	2.95	

HEADSETS—MICROPHONES:

Head & Chest Set for EE-8—Used	$2.95
Dynamic Microphone & Headset for Mark II—Used	$1.95
	New 2.95
HS-30 Headset—New	1.95

TUNING UNITS COILS

TU-7-8-9-10-26 for BC-191-375—Used	$3.95
IF Transformers f/274N—85 KC—1415 or 500 KC—Ea.	1.80

AMPLIFIERS:

BC-605 Amplifier—Used	$3.95
BC-347 Amplifier with Tube	2.95
BC-709 Amplifier	4.95

PLUGS AND CONNECTORS:

PL-112 Plug for LP-21 Loop	$1.25
PL-P-103 Plug for BC-348	1.50
MC-211 Rightangle Adapter for Comm. Sets	.50
M-359 Rightangle Coaxial Connector	.25

MOUNTINGS AND CLAMPS:

FT-154 for BC-348 Receiver	$2.50
FT-470 Mounting & Clamp	1.00
MC-476 Maple Ball for above—f/Fairlead	1.00
MC-306 Wood Clamp for Fairlead	.75
M-235 Bobbin & 250 Ft. W-106 Antenna Wire	3.50
WT-7 Weight for Trailing Antenna	1.50

AUTOSYN TRANSMITTER:

Autosyn Transmitter from LP-21A Loops, used with 1-81 or 1-82 Indicators. Operates from 28 Volt 400 cycle. With calibrated Dial and Correction Pointer. MC-507 ..... **$6.95** MC-217 ..... **$8.95**

GEAR TRAIN MOTOR



Ball bearing, low inertia reversible type, 588 RPM. Extra large gear. 5 RPM operates 28 Volt 400 cycle or 12 Volt 60 cycle. Removed from LP-21 Loops. Type 10047-2-A **$4.95**

BAND SWITCH MOTOR and Switching Assy for MN-26 Compass. 28 VDC 2 E11500 I **$5.95**

AIRCRAFT KITCHEN GALLEY—Type C-2, 24 Volt DC operation complete w/Food Warmers, Grill & Soup Can **$34.95**

NOTICE

NEW POSTAL REGULATIONS, effective January, 1952, place 20 lb. weight limit on parcel post shipments. All shipments over 20 lbs. accordingly shipped via Motor Freight or Express. C.O.D. and postal M.O. Fees up to $5—10c—$10-$25—25c—$25-$50—35c. When ordering $5—10c—$10-$25—25c—$25-$50—35c. When ordering $5—10c—$10-$25—25c—$25-$50—35c. When ordering **SEND ENOUGH MONEY AND SAVE! ANY BALANCE WILL BE REFUNDED IN CASH AT ONCE!**

DYNAMOTORS:



DYNAMOTOR And BLOWER
6 Volts DC input, output 450 Volts 60 MA. 6500 RPM. At **6 Volts DC input,** output 300 Volts 65 MA. 3000 RPM. Price **$4.95**

INPUT:	OUTPUT:	STOCK No.:	PRICE:
14 V. DC	600 V. 300 MA.	RD-86	$9.95
12 V. DC	220 V. 70 MA.	DM-24	6.95
12 V. DC	220 V. 100 MA.	DM-18	4.95
12 or 24 V. DC	440 V. 200 MA. & 220 V. 100 MA.	D-104	9.95
14 V. DC	375 V. 150 MA.	DM-375	6.95
14 V. DC	330 V. 135 MA.	DM-330	7.95
14 V. DC	500 V. 500 MA.	PE-59	14.95
12 or 24 V. DC	275 V. 110 MA.	USA/6510	3.95

ALSO—PE-73; PE-86; DM-33; DM-33; 5055; DM-416; PE-101, etc.

BLOWERS:



115 Volt 60 cycle BLOWER (pictured), approx. 100 CFM Dia. 2¼" intake; 2" outlet. Quiet running. Motor size: 2⅛"x3¼". NEW—not Gov't surplus. **$7.99**
Order No. RN-520.

DUAL BLOWER—Same as RN-520 above, except has blower assembly on each side of motor. Order No. RN-800 ..... **$12.95**

METERS:

0-150 Volt, 400 cycle, 2½" Rd.	$3.95
0-5 Amp. AC, 2" Rd., 0-75A Scale	3.95
0-5 Milliamp DC, 2½" Sq., 0-5 Scale	3.95
0-1 Milliamp DC, 2½" Rd., 0-150 Scale	3.95
0-500 Microamp, 2½" Rd., 0-15 & 0-600 DC Volt Scale	3.95
TUNING METER I-70B Reverse Scale, Weston E606 for Compass Control Boxes	3.95

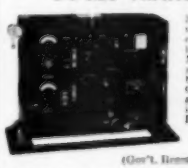
POWER SUPPLIES:

VIBRATOR TYPE—6 Volt DC input; output 220 Volt DC 50 MA. filtered w/tube. Size: 4⅞"x4"x3⅞". Price **$6.95**

VIBRATOR TYPE—6 Volt DC input; output 220 Volt DC 50 MA—not filtered—w/tube. Ideal for Command Receiver operation, as receiver is filtered internally. Size: 4⅞"x4¼"x3⅞" **$4.95**

PE-157 POWER SUPPLY. 2 Volt Vibrator Supply, operates from BB-54 2 Volt Battery mounted in Case. Output voltage 1.4 V @ ⅛ Amp 125 V @ 50 MA. Less Battery, Speaker, & External Power Cord—with Vibrator **$4.95**
BB-54 2 Volt Dry Battery **2.95**

BC-223 TRANSMITTER



30 Watt transmitter with Crystal or MO control in four pre-selected channels. CW, MCW cover frequency range 2000-3200 KC. By use of plug in coils. Complete with tubes and choice of one Tuning Unit (listed below). Less Mtg.—Perfect: NEW: $37.50
USED (Gov't. Reconditioned) **$26.50**

CABLE—Trans. to Power Supply $2.00
TUNING UNITS: TU-17—2000-3000 KC; TU-16—3000-4500 KC; TU-25—3500-5250 KC ..... **$3.50 EACH**
Spare VIBRATOR & TUBE KIT f/PE-125RX ..... **$ 5.95**
PE-125RX POWER SUPPLY f/BC-223—12/24 Volt input; output 475 Volts 150 MA. NEW **14.95**
SPARE TUBE KIT in metal box, f/BC-223 ..... 2.50
OPERATING MANUAL for BC-223AX 2.50
SHOCK MOUNTING for PE-125 ..... 1.00
FT-173 MOUNTING for BC-223 ..... 2.00
BC-223 TRANSMITTER—Incomplete, for parts, no front panel or meters. Price—As Is **$4.95**

TRANSFORMERS AND CHOKES

TRANSFORMERS—110 V. 60 CYCLE PRIMARIES:

Sec. 6.3 Volt 1 Amp	$1.25
Sec. 24 Volt ½ Amp	1.25
Sec. 24 Volt 1 Amp	1.95
Sec. Two 12 V. 4 A. windings—Use 12 V. 8 A. or 24 V. 4 A.	5.95

CHOKES:

H-115 8 Henries 500 MA Filter, 5000 V Ins.	$10.95
H-121 13 Hy. 250 MA Filter, 1500 V. Ins.	4.95
H-412 4-12 Hy. Swinging, 200 MA, 2500 V Ins.	4.95

Address Dept. RN • Minimum Order $5.00 • Prices F.O.B., Lima, O. • 25% Deposit on C.O.D. Orders

FAIR RADIO SALES
132 SOUTH MAIN ST
LIMA, OHIO

AT LAST! TV RECEPTION UP TO 200 MILES

ON ACTUAL FIELD TESTS WITH

NEW DX630 CHASSIS

USING THE CASCODE TUNER

will operate in fringe areas or in localities remote from TV broadcast stations up to 200 miles.

HAS 4 MICROVOLT SENSITIVITY—10 times any other TV receiver. Will pick up distant stations without use of boosters or special antenna arrays—and with less noise. Will operate any tube including 24", greater brilliance, improved keyed AGC circuit, [eliminating flickering and fading]. Uses the best materials with a high factor of safety to insure trouble-free operation. STD RTMA GUARANTEE free replacement of defective parts or tubes for 90 days. Completely factory wired chassis ready to operate with 12" P.M. Speaker.
Price including excise tax $148.95

TELEVISION PICTURE TUBES

Standard makes, 1 year guarantee, all prices include 10% excise tax. (See ad for prices.)

TELEVISION CABINETS

We have a large variety of table model, consolette and combination cabinets DESIGNED TO PLEASE the most discriminating tastes. Beautifully finished, mostly handrubbed available in mahogany, walnut, and blond colors. Table model (outside dimensions 23⅝" x 24" x 24") price in mahogany for all sizes up to 20", including mask, and 10% excise tax. $34.95
Extra for glass $2.75

Consolette cabinet of beautiful design made of the finest veneers and good finish. Size 39" high x 24" wide x 22½" deep finished in mahogany or walnut. Cut for 630 chassis with 12" speaker will take either 16, 17, or 20" tube. $43.95
Price including mask and excise tax
Extra for glass $2.75

For the various other cabinets in our large selection we will furnish photos and other NECESSARY INFORMATION ON REQUEST. New Dumont conversion kit. Send for Free Catalog.

TELEVISION PICTURE TUBES

Standard Brands

ONE YEAR GUARANTEE

12½" (Black or White)	$23.95	Glass 16" Round (Black)	$34.50
Glass 14" Rectangular (Blk.	$23.50	Glass 16" Rectangular (Blk.)	$34.50
17" Rectangular (Blk.)			$31.95
19" Round (Blk.)			$39.95
20" Rectangular (Blk)			$39.95
21" Rectangular (Blk)			$42.95
24" Metal			$69.95

New—DuMont True Focus Conversion Kit

Convert your old set for even focus over entire screen!
DuMont 70° Yoke, Model Y2A1—distributed winding $8.97
DuMont 70° Flyback Transformer Model M1A1 ..... 6.97
DuMont Linearity control—for above units 75
DuMont Width Coil for above units 75

TELEVISION COMPONENT SPECIALS

NEW STANDARD COIL CASCODE TUNER

Uses 1-6J6 and 1-6BK7 Intercarrier $19.95

New Dumont Jr Tuners Sound Center I.F. 21.25 or 21.75 ..... $23.40
Plus your old Tuner

TELEVISION HI-PASS FILTER

Cuts off at 50 Mc with a high attenuation at approx. 40 Mc. Eliminates interference from electrical appliances, short wave, and Amateur radio transmitters, diathermy and x-ray machines $3.34

All Merchandise Subject to Prior Sale. All Prices Subject to Change without Notice.

WRITE FOR COMPLETE CATALOG N-3

EDLIE ELECTRONICS INC.

184 Greenwich St. New York 6, New York

A. Orientation. A simple means of antenna orientation is important if optimum signal-to-noise ratio is to be obtained on each channel. Proper orientation facility minimizes picture smear, the influence of reflections, impulse noises, and local oscillator radiation. It permits better raster stability and a more motionless background.

B. High erection is important at a vast majority of sites from the standpoint of peak signal and keeping the antenna above obstacles and room activity.

C. To intercept a peak signal, it should be possible to fully extend the elements. It should be possible perhaps to derive some gain from the antenna on the high band.

D. Antenna should be designed so it can be mounted in an out-of-way or hidden position. The antenna for a television receiver is a utilitarian device and doesn't lend itself too well to ornamentation if effective performance is to be attained.

Indoor "Directronic"

An indoor "Directronic" type of antenna displays excellent indoor characteristics. The basic type used for indoor application consists of three quarter-wave elements spaced in 120 degree relation (can be mounted at other angles to fit space available) and feeds a three-wire transmission line, Fig. 1. The three-wire line connects to a six-position switch mounted at the receiver (near antenna terminals) while an ordinary 300 ohm two-wire line connects the switch and receiver input. The switch, Fig. 1, chooses the elements in pairs, (1-2, 2-3, 1-3) or chooses two elements to work with a single (1, 2-3; 2, 1-3; 3, 1-2). A wafer-type of ganged switch is used, so arranged that the two six-pole portions operate together. In the three lower positions, the corresponding single-pole switch shown at the left in the diagram is also closed. For example, in the bottom switch position, the left-hand single-pole switch is closed; the next position up closes the center single-pole switch, and the third position up closes the right-hand switch. This arrangement allows six orientation possibilities—more than enough to fit the orientation requirements. The orientation feature is not only advantageous as a signal level adjustment, but it permits orientation away from interference and changing directions of interference arrival (such as local oscillator radiation in a crowded neighborhood). The forward tilt of elements permits some high-band gain.

The antenna elements are standard 46 inch lengths made of *aluminum tape*. The tape can be made to adhere firmly to painted surfaces, wallpaper, etc. The antenna can be mounted on the ceiling or, better still, hidden away on a closet ceiling. The antenna itself need not be oriented physically and the benefit of a full length element can be obtained. It is mounted at ceiling level and is little influenced by receiver positioning and room activity.

FOR FRINGE AREA & DX
the New DAVIS
SUPER-VISION
ANTENNA

Built to the same **Davis High-Quality Reception Standards** which have made **Davis Electronics Products** so popular with users and the trade. **Backed by over a quarter of a century of electronic experience.**



MANY OUTSTANDING FEATURES:

- **Broad-Band Receiving**—Channels 2 to 13.
- **Eliminates** or **Greatly Reduces "Ghosting" Problems.**
- **Provides 10 DB or More Gain on High Channels**—where gain is most needed.
- **Excellent Front-to-Back**—on all channels.
- **Minimizes Interference**: Airplane Flytter—Diathermy and Ignition—F. M.—Neon Signs—X-Ray—Industrial—Etc.
- **Can Be Tipped WITHOUT Tilting Mast.**
- **Jiffy Assembly.** Light-weight rugged construction.

AT YOUR JOBBERS, OR WRITE TO:

DAVIS ELECTRONICS 1-3
3047 W. Olympic Blvd., Los Angeles 6, California
GIVE ME INFORMATION TO BE AS CHECKED BELOW:
☐ Send Free Technical Data on new SUPER VISION ANTENNA.
☐ Send Name and Address of NEAREST JOBBER.
Name _____
Street _____
City _____ State _____

No Experience Needed To
PRINT YOUR OWN POST CARDS



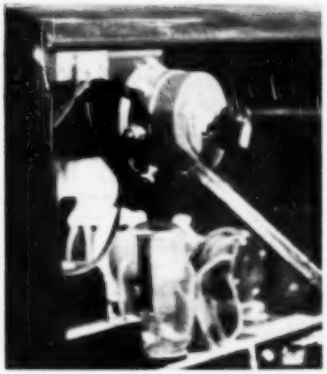
The GEM STENCIL DUPLICATOR saves money . . . gets results quickly! Hundreds of uses for every type of business and organization. We ship the GEM complete with all supplies, Guide Board for accurate printing and 60-page Book of Ideas at the special low price of only **$8.50** (a $15.00 value)

Our 21st Year

FREE TRIAL OFFER

Use the GEM **FREE** at our expense! SEND NO MONEY. Write and complete GEM outfit will be sent you postpaid. After ten days, send us only **$8.50** or return the GEM. You must be satisfied! WRITE TODAY.

BOND EQUIPMENT CO. Dept. 52
6633 Enright • St Louis 5, Mo.



"Directronic" switch installed in TV set.

An indoor "Directronic" is able to take effective advantage of whatever signal levels are present. It will not be able to deliver as strong a signal as a proper outdoor antenna because, generally speaking, the signal levels are substantially weaker indoors. Nevertheless, recent increases in transmitter power and more sensitive tuners are used to advantage in a well-planned, versatile indoor antenna installation. An antenna of this type installed on an attic ceiling approaches the performance of a good outdoor antenna and is better than the poorer outdoor installations.

Typical mounting sites (see page 42) include a room ceiling, closet ceiling, or attic ceiling. A room ceiling mount can be made presentable if installed neatly—it should be very satisfactory for a den, recreation room, bedroom, hall, etc. Closet ceiling mounting is ideal from the standpoint of appearance and performance. Tape elements can be made to follow the contours of a small closet, running down corners or sides—full length elements being more important than the fact that the elements do not remain strictly in a horizontal plane.

The indoor "Directronic" is convenient for attic ceiling mounting and for mounting on ceilings of unfinished second floors.

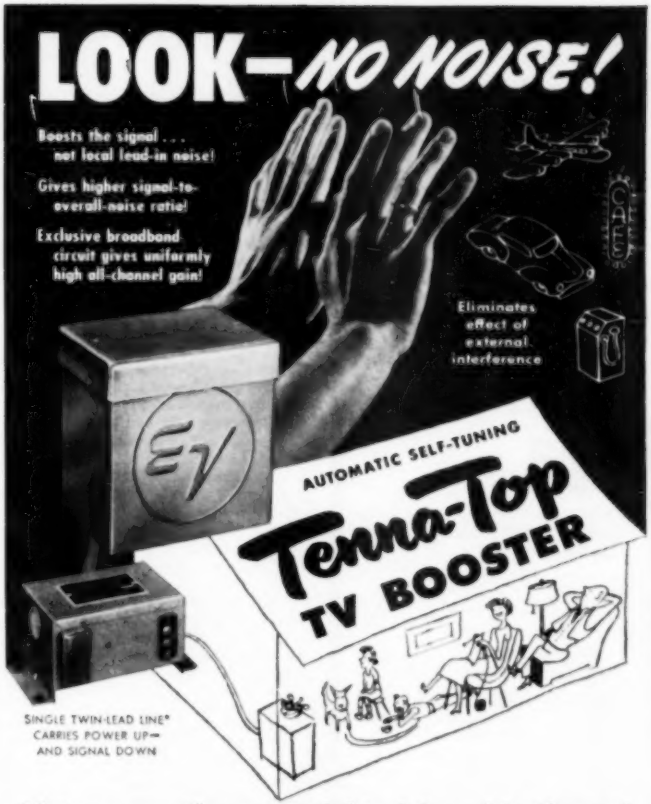
Indoor tape antennas of the "Directronic" type have among their features: high and hidden mounting possibilities, electronic orientation, full length elements, high signal level, and interference rejection possibility by pattern orientation. —30—

HANDY TEST LEADS

By HUGH LINEBACK
Oklahoma A & M College

SERVICEABLE and convenient test leads may be made by using ordinary parallel conductor, rubber-covered lampcord.

By adding the desired terminals and splitting the ends for a short distance, there is really only one wire to worry about instead of two separate ones. Bands of tape are used to keep the cord from separating too far. —30—



Pictures are Sharper, Brighter! Sound is Clearer!

You can *see* and *hear* the difference when you hook up the TENNA-TOP. Because it is mounted at the antenna ahead of the lead-in...it amplifies only the wanted TV signals, not any local noise interference produced by automobile ignition systems, neon signs, diathermy, or other external noise picked up by the lead-in. You have the further advantage of E-V low-noise circuit. All this guarantees the best possible results with any TV set anywhere...even in toughest fringe areas or in all noisy locations. The TENNA-TOP is completely automatic. Turns "On" or "Off" with the TV receiver switch. It is easy to install, highly stable, trouble-free.

Model 3010 Tenna-Top TV Booster. List Price . . .$88.00



Tune-O-Matic
TV BOOSTER

Famous E-V broadband booster—proved in thousands of installations! Uniform high gain—low noise circuit. Automatic self-tuning for all channels. Easily concealed.

Model 3000, 4-stage, List $57.50
Model 3002, 2-stage, List $39.50

Electro-Voice

TV BOOSTERS • MICROPHONES • HI-FI SPEAKERS • PHONO PICKUPS

Send for Free Bulletin

Electro-Voice, Inc., Dept. N3-52
410 Carroll St., Buchanan, Michigan
Send Free Bulletins 163-165

Name _____ (PLEASE PRINT)

Address _____

City _____ Zone _____ State _____

☐ Serviceman ☐ Installer ☐ Dealer ☐ TV Fan

*Patent Pending

STEEL TOWERS and MASTS
Tubing - Roof Mounts - Guy Rings
PRODUCTS
for T-V and ELECTRONICS



Model 100 —
Kwick Climb Tower

This light weight tubular steel tower comes in 10' sections with slip joints that require no bolting. Safe and easy to climb. Top section has sleeves for up to 2¼" mast. Base adaptable to any pitch roof. Additional sections may be added to 100 feet. 30' tower complete with base weighs 80 lbs. Additional sections 22 lbs. each.

MODELS 130 and 140, 30 foot and 40 foot Manually Telescoping Masts. Priced for that inexpensive installation.



Pat. Pending

Model 115 —
Krank Up Mast

27' telescoping crank up mast complete with all hardware. Cranks to any positive position from 10' to 27'. Made of sturdy 2", 1½" and 1¼" tubing. Easily installed.

Model 125 —
Krank Up Mast

47' telescoping crank up mast complete with all hardware. Same as Model 115 in construction. Will telescope to any positive position from 20' to 47'. Weight 45 lbs.

A locking device on both of the above models removes all the strain from the cable.



ROOF MOUNTS

Model A-S — Apex Roof Mount
A sturdily constructed Roof Mount with 4-way swivel. Fully adaptable to any type of mounting. Will take up to 2¼ inch tubing.

ALSO
MODEL S, Rotary 4-way T-V mast base mount
MODEL P, 2-way swivel T-V mast base mount
RUGGEDLY CONSTRUCTED MOUNTS - LOW PRICED

QUALITY PRODUCTS SOLD THRU RECOGNIZED JOBBERS

JOBBERS and DISTRIBUTORS
WRITE FOR PRICES AND LITERATURE

JONTZ MANUFACTURING CO.
1101 E. McKINLEY AVE.
MISHAWAKA, INDIANA

Audio Simplified

(*Continued from page 74*)

The basic principle of operation of the volume compressor or expander is shown in the block diagram of Fig. 6. The audio signal is amplified to a sufficiently high level, and then rectified to give a d.c. voltage proportional to the signal level. This voltage controls the gain of a variable-gain stage in such a manner that the gain may be either reduced or increased as the signal voltage increases, depending upon whether the circuit is to be a compressor or an expander. A gain control in the amplifier-rectifier circuit can be used to control the amount of compressor or expander action, and a delay voltage can be introduced into the rectifier circuit so that the action only occurs above a certain level.

The circuit of a simple compressor or expander is shown in Fig. 7A, and the principle of its operation may be seen most clearly from the simplified diagram and equivalent circuit shown in Fig. 7B. The input signal is rectified, and the developed voltage applied to the grid of a triode whose plate resistance forms the shunt resistor in an audio-frequency voltage divider network. The equivalent circuit shows this principle of operation, and it can be seen that with proper selection of the resistor values, if the plate resistance of the tube is made to vary properly, the output signal level can be controlled over a wide range of input levels.

A simple practical circuit based on this principle is shown in Fig. 9A. The input signal is amplified by one-half of the 6SL7 dual triode, whose output is rectified by the second half of the tube connected as a diode. The voltage from the diode rectifier is then a measure of the signal level. This voltage is properly filtered and applied to the grid of one-half of a 6SN7 tube to control its plate resistance, which is used as the variable resistance in the audio voltage divider circuit. The voltages are chosen so that for high signal levels a positive voltage is applied to the grid of the variable-resistor tube, which lowers its plate resistance and therefore decreases the gain of the channel. This compression circuit is capable of giving a compression up to 10 to 15 db with 0.5 volt rms applied to the input.

The operation of a peak limiter may be compared to that of the compressor, and may be considered as having a very high degree of compression which takes place only when the input signal becomes greater than some specified level. The circuit of a peak limiter whose operation is based upon the

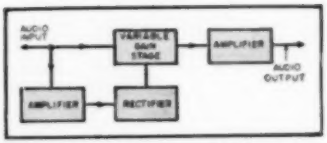


Fig. 6. Basic block diagram of volume compressor, peak limiter, and expander unit.

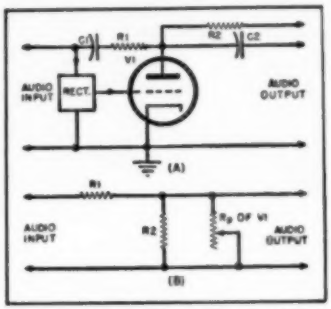


Fig. 7. Simple basic circuit for volume compression or expansion (A) and equivalent circuit of (A) for audio signal (B).

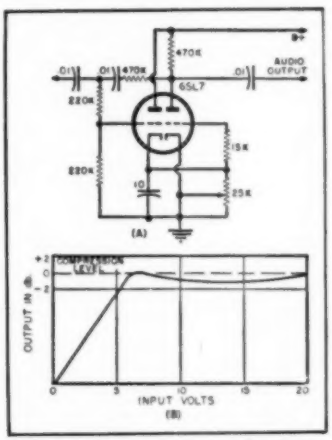
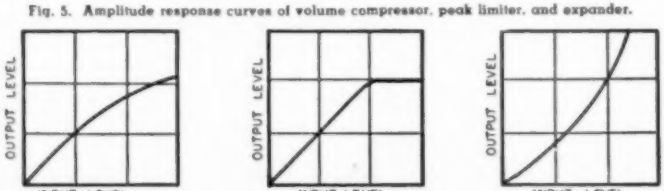


Fig. 8. (A) Peak limiter circuit, and (B) the amplitude response of peak limiter circuit.

Fig. 5. Amplitude response curves of volume compressor, peak limiter, and expander.



Lowest Prices Largest Stock — TUBES and PARTS

All TUBES are guaranteed for one year . . individually boxed. **10% DISCOUNT** on orders of 100 tubes or more, all brands.

USE THIS ORDER BLANK—

Quantity		Quantity		Quantity		Quantity		Quantity		Quantity	
0Z4	59c	6AB7	$1.15	6J5GT	$ .54	7A6	81c	12BE6	$ .65	35B5	72c
0Z4G		6AC5GT	1.31	6J6	1.04	7A7		12BF6	.59	35C5	
1A5GT	.65	6AC7		6J7G	.79	7A8		12BH7	1.08	35L6	.59
1A7	.99	6AG5	1.19	6J8G	1.15	7B4		12C8	1.15	35W4	.45
1B3GT	.95	6AG7	1.44	6K5GT	.87	7B5		12F5GT	65c	35Y4	99c
1B5	29c	6AH6	1.40	6K6GT	.59	7B6		12H6		35Z3	
1C7G		6AK5		6K7GT	.79	7B7		12J5GT	.54	35Z4	54c
1E7		6AK6	1.08	6K8GT	.87	7B8		12K7GT	.79	35Z5	
1H6		6AL5	72c	6L5G	.95	7C4		12Q7GT	.65	35Z6G	.95
1H5GT	.65	6AQ5		6L7	.87	7C5		12SA7GT	.72	35 51	.79
1H6G	1.15	6AQ6	.81	6N6G	1.40	7C6	81c	12SC7	.79	41	
1J5GT	.95	6AR5	.74	6N7GT	1.08	7C7		12SF5GT	72c	42	72c
1L4	.29	6AT6	.54	6P5GT		7E6		12SF7		43	
1LA4		6AS5	.90	6Q7GT	.65	7E7		12SH7GT	.79	45	
1LA6	1.19	6AU5GT	1.45	6R7GT	.95	7F7		16SJ7GT	.81	45Z5	.59
1LC5		6AU6	59c	6S4	.65	7F8		12SK7GT	.72	46	1.04
1LC6		6AV6		6S7GT	1.15	7G7		12SL7GT	.87	47	
1LD5	.95	6B4G	1.44	6S8GT	.95	7H7		12SN7GT	.99	50A5	1.21
1LE3	1.19	6B5		6SA7GT	.72	7J7		12SQ7	.54	50B5	72c
1LH4	1.19	6B6G	.79	6SC7	99c	7K7	1.19	12SQ7GT	.59	50C5	
1LN5	1.19	6B8GT	1.15	6SD7GT		7L7		12SR7GT	.79	50C6G	1.04
1N5GT	.72	6BA6	.65	6SF5	.59	7N7	99c	12Z3	.95	50L6	.59
1P5GT	95c	6BA7	.87	6SF5GT	.65	7Q7		14A7		50X6	.79
1Q5GT		6BC5	.72	6SF7	.72	7R7		14AF7	99c	50Y6	.59
1R5		6BC7	.79	6SH7GT	.79	7S7	1.19	14B6		70L7	1.40
1S5	72c	6BD5GT	1.15	6SJ7	81c	7V7		14B8		71A	.87
1T4		6BE6	.65	6SJ7GT		7W7		14C5	1.19	75	1.10
1U4		6BF5	.99	6SK7GT	.58	7X6	.99	14C7	1.08	77	.61
1U5	.65	6BF6	.59	6SL7GT	.87	7X7	1.19	14F7	.99	78	1.45
1X2A	.95	6BG6G	1.73	6SN7GT	.79	7Y4	81c	14F8	1.44	80	.79
2A3	1.15	6BH6	72c	6SQ7	.54	7Z4		19B8GG	2.15	85	
2A5	.79	6BJ6		6SQ7GT	.59	12A7	1.15	19T8	1.04	117L7	1.40
3LF4	1.19	6BN6	1.44	6SR7GT	.65	12A8	.79	20	1.49	117N7	
3Q4	.79	6BQ6	.85	6SS7	.72	12AH7	1.45	24A	.79	117P7	.54
3Q5GT	1.08	6BQ7	1.58	6T7G	1.15	12AT6	.54	25AC5GT	1.04	117Z3	1.08
3S4	72c	6C4	59c	6T8	1.10	12AT7	1.04	25BQ6GT	1.15	117Z6	1.55
3V4		6C5GT		6U5	79c	12AU6	.72	25L6GT	.59	807	8.95
5T4	1.40	6C6	.79	6U6GT		12AU7	.65	25W4GT	.72	813	
5U4G	.59	6C8G	1.15	6U7G		12AV6	.54	25X5	1.04	1294	29c
5V4G	.87	6CB6	.72	6V6GT	.59	12AV7	1.15	25Z6GT	.79	1299	
5W4	59c	6CD6G	1.69	6W4GT	.65	12AW6	.95	32L7GT	1.15	1619	.45
5W4GT		6D6	.79	6X4	.54	12AX7	.87	35A5	.99	1629	.29
5X4G	.65	6D8G	1.15	6X5GT	.68	12BA6	.65	35B5		2050	2.00
5Y3GT	.45	6E5	.79	6Y6G	.87	12BA7	.87	35C5		2051	1.15
5Y4G	.54	6F5GT		7A4	.90			35L6		7193	.87
5X4G	81c	6F6GT	59c	7A5	.99			35W4		VT51	29c
5Z3		6F8G	1.15					35Y4		VT52	
6A3	1.15	6G6G	.95					35Z3			
6A7	1.21	6H6	.59					35Z4			
6A8GT	.99	6H6GT	.65					35Z5			

TUBE SPECIALS!

6AU6	ea. 59c	6SK7GT	ea. 58c
6V6GT	ea. 59c	6BQ6GT	ea. 85c
12AU7	ea. 65c	6CD6G	ea. $1.69

RESISTOR KITS

Insulated 1/2, 1 and 2 watt assortment of most used values, best brands. 100 for 50 asst.—$2.95 — **$4.95**

JOBBERS: Write for quantity discounts

RESISTORS

You pick them, we ship them. Insulated—best U. S. brands.

ANY RESISTANCE

In lots of 10

1/2 watt	20%	3½c ea.	1 watt	20%	4½c ea.
	10%	5c ea.		10%	7½c ea.
	5%	9½c ea.		5%	15c ea.

2 watt — 20% ..... 10 for 60c
2 watt — 10% ..... 10 for 95c
2 watt — 5% ..... 10 for $2.15

TUBE KITS

BEST BRANDS at BEST PRICES

1Q4, 1T4, 1R5, 1S5. List Value $8.00. Tube Kit only $2.39

3S4, 1T4, 1S5, 1R5. List Value $7.80. 4 Tube Kit $2.39

1U4, 3S4, 1S5, 1R5. List Value $7.80. All Four Tubes for $2.39

1V4, 1R5, 1S5, 1T4. List Value $7.80. All for $2.39

117Z3, 1U5, 1V4, 1R5, 1T4. AC-DC Portable Kit. All for $2.89

12AT6, 12BA6, 12BE6, 35W4, 50B5. 5 Tubes for $2.95

50L6GT, 35Z5GT, 12SQ7GT, 12SK7G, 12SA7G. 5 Tubes for $3.22

TV PICTURE TUBES

Six month guarantee

10BP4	$12.95	16JP4	$29.95
12LP4	$16.95	16RP4	$29.95
12LP4A	$16.95	16TP4	$29.95
14PB4	$22.95	17BP4A	$31.95
7JP4	$17.95	19AP4A	$39.95

TWIN LEAD

300 ohm twin lead 55 Web virgin polyethylene, in either clear or brown, the finest available.

1000 ft. $18.50 | 100 ft. $1.95

Get our special sales bulletins . . . write TODAY!

6 FOOT LINE CORD

will be scarce — UL approved cord and plug—10 for $1.98

TUBULAR ELECTROLYTIC FILTER

40-20 mfd., 150 V—with 20 mfd., 15V 20c ea.
TUBULAR MOLDER—8 mfd., 400V 16c ea.

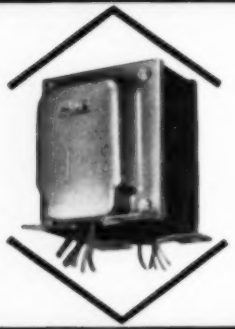
TV INLINE FOLDED DIPOLE ANTENNA

At this price we cannot mention manufacturer's name, complete with mast, ind. boxed. $7.98 each. 6 for $7.29 each.

TERMS: 20% DEPOSIT with order, balance C. O. D. $1.00 handling charge for orders less than $5.00. All shipments F.O.B. Chicago. Our parts and tubes are warranted to be 100% replacements for the prototypes in the listings above. Prices are subject to revision without notice. SATISFACTION GUARANTEED. Illinois residents add 2% sales tax. ORDER TODAY!

Premier RADIO TUBE CO. 551 W. Randolph St. Chicago 6, Illinois ANdover 3-1590

TRIAD
General Purpose
POWER
Transformers



Tested...to meet your requirements and excel in performance...

TRIAD general purpose Power Transformers are specially designed, not only for replacement, but for use in electronic equipment for industry, for PA amplifiers, and for amateur gear.

All types are **"Climatite" treated,** both coil and core, for protection against moisture and for elimination of lamination chatter. Laminations are painted to prevent rust. Although small in size, the high quality materials used in these transformers keep losses to a minimum. Only copper coils for static shields, grounded to case and core, are used. Leads are UL approved for high temperature operation. Final tests include checking for correct operation and stressing **in all ways beyond maximum operating potential.** Beautifully finished in gray enamel with **all specifications on decal on the case.**

Remember! Only Triad Transformers are "Climatite" treated

Available from stock at leading jobbers

Write for Catalog TR-51

TRIAD TRANSFORMER MFG. CO.

2256 Sepulveda Blvd. Los Angeles 64, Calif.

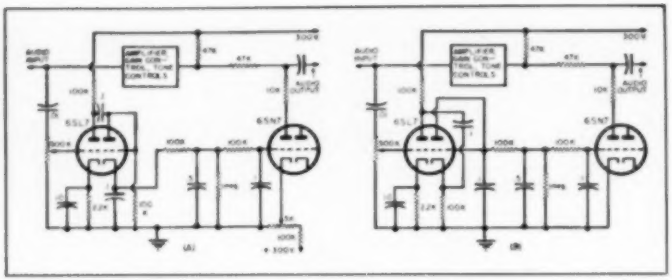


Fig. 9. (A) Conventional volume compressor circuit and (B) volume expander circuit.

same audio voltage-divider principle of Fig. 7 is shown in Fig. 8. The input signal is rectified by a high-impedance cathode detector which is the first section of the 6SL7, and the developed voltage is applied between the grid and cathode of the second section of the 6SL7 which acts as the variable shunt resistance of the voltage divider. The values of the components have been selected to give the best voltage/signal-level characteristic to result in a linear compression curve. This circuit gives a peak-limiting curve similar to that shown in Fig. 8B, and is capable of 15 to 20 db limiting with an output level change of less than 1 db. The limiting action is initially adjusted by means of the 25,000 ohm cathode resistor, and then the degree of limiting for any transmitted audio signal is adjusted by controlling the level of the signal applied to the input of the limiter circuit.

A volume expander is essentially the reverse of the compressor circuit which has already been described. The major difference between the two is that the diode rectifier must be reversed and the voltage levels reset, so that for high signal levels the channel gain is increased. Thus, the circuit of Fig. 9B is essentially the compressor circuit of Fig. 9A with the rectifier connections reversed to give a negative voltage when the audio level increases, and the cathode of the variable-resistance tube connected directly to ground

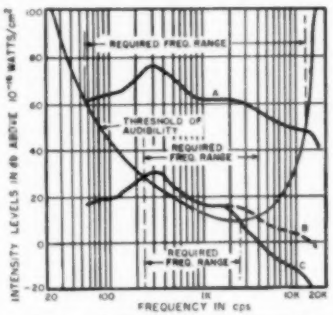
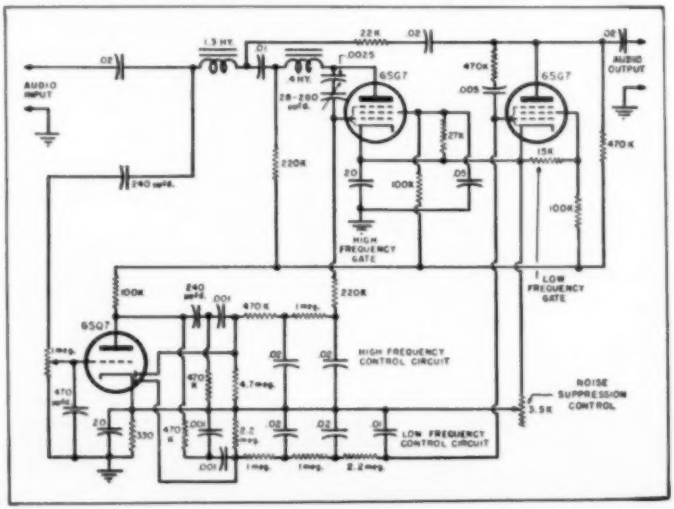


Fig. 10. Required frequency range for music at different levels. Curve A is the most probable frequency distribution in music at high levels. Curve B is same as A at lower volume. Curve C is the most probable frequency distribution with the orchestra playing soft passages.

Fig. 11. Circuit diagram of the Hermon Hosmer Scott dynamic noise suppressor which is particularly well adapted for use in a sound reproducing channel.



so that the plate resistance is low for low-level signals and high for high-level signals. The gain therefore increases as the audio level increases. This circuit is capable of giving up to 10 db expansion, and component values may be selected to give greater expansion if desired.

In the use of volume compression and expansion circuits, the time constants of operation are extremely important, and generally represent a compromise of several factors. The time of initial operation should be rapid to act properly on the initial peaks, but the release time presents a more difficult problem. If the release time is too short, a sort of "pumping" effect is obtained in which the gain is constantly adjusting to rapid changes in level; while if it is too long, sharp dynamic effects in the program material will suffer. Optimum conditions are a very rapid initial operation time, and a release time of about one-half second to one second.

The units which have been described can either be included directly in the amplifier, or be constructed on a separate chassis with the gains and levels adjusted for unity gain at some specified level (which will require the inclusion of additional amplification), and switched into the channel whenever they are required.

Noise Suppression

Another approach to the problem of background noise has been to attempt actually to remove the noise which has been introduced into the reproduced sound. A number of different methods have been developed for this purpose. The most widely accepted of these methods is the *dynamic noise suppressor*, whose operation is based essentially upon the fact that the frequency response of the ear changes with sound level.

Detailed curves which have already been reproduced in Part 1 (Fig. 4, page 50, September 1951 issue) of this series show the effects of different loudness levels on the human ear. The ear does not have the same frequency response for different acoustic levels, that is, at high levels its response is approximately flat, while at low levels the sensitivity to high and low frequencies is considerably reduced. The basic data from these curves is reproduced in Fig. 10, which shows the curve for the lowest levels which can be heard by the ear at each frequency. On the same graph are also shown the most probable frequency distribution in music at high levels (curve *A*), this same distribution at about a 25 db lower level (curve *B*), and the frequency distribution when the orchestra is playing softly (curve *C*) showing that the production of harmonics in soft playing is less than in loud. These curves show that all components which are outside the intersections of these curves with the hearing threshold curve are not perceived by the ear, and if a filter which cuts off at these frequencies is inserted in the channel



Now Available Separately

TRIO Phasitron

makes every TV antenna more efficient . . .

The TRIO PHASITRON, originally sold only as part of the TRIO Controlled Pattern TV Antenna System, is now available separately for set owners who want the very best performance from their sets and antennas.

PHASITRON acts as a continuously variable tuning stub, provides exact impedance match between transmission line and booster or set. Helpful in matching booster output to set input. Because of exact matching—provided by PHASITRON—line losses become negligible and set performance greatly improved. Use also to coordinate input from two or more antennas to provide added balanced output to set.



ELIMINATES CO-CHANNEL INTERFERENCE

PHASITRON, when used with the amazing TRIO "CONTROLLED PATTERN" Antenna System, actually tunes out interference from stations on same channel as the one desired. Thus, Venetian Blind Effect—when caused by co-channel interference—is completely eliminated; a great benefit in many fringe areas!

IDEAL FOR HAMS, EXPERIMENTERS

PHASITRON, for the first time, provides a line matching device of laboratory precision at a price everyone can afford. Hams and experimenters will find the PHASITRON of utmost value in obtaining increased transmission line efficiency.

Available at your jobber or write for details.

TRIO Manufacturing Company

GRIGGSVILLE, ILLINOIS

ELL ON DEMONSTRATION
DuKANE
MAGNETIC TAPE RECORDER



THE FINEST IN HIGH FIDELITY RECORDING *at* **LOW COST!**

DEALERSHIPS AVAILABLE *NOW!*
***MAIL COUPON* FOR INFORMATION TODAY!**

DUKANE CORP. Dept. RTN-32, St. Charles, Ill.
☐ Please send information on the DuKane Magnetic Tape Recorder.
☐ I am interested in a dealership.
Name _____
Address _____
City _____ State _____
ESTABLISHED AS "OPERADIO" 1922

SCARCE SURPLUS
PANADATOR NAVY TYPE RBU-2



A precision, instrument built to the highest standards of quality and long dependable service. Input frequencies in combination to attention for 135 kc. included with each.

Characteristics
Screen, 115-230 V. A.C. 50-70 cps.

60 Watts. Max. sweep width—50 kc. Input frequency 455 kc. Input level 100 microvolts—10 Megacycles. I.F. freq.—262 kc. Appr. osc. mean freq.—625 kc. Appr. osc. swing—25 kc. Sweep freq.—60 cps. Sweep wave form—Linear. Has built-in, complete with tubes and manual.

BRAND NEW QUANTITY LIMITED ONLY $169.50

OSCILLOSCOPE POWER SUPPLY KIT
For 3 to 5 inch tubes. Hermetically sealed transformer has high output voltage and necessary filament windings. Kit includes transformer, choke, filters, rectifier tubes, tube sockets, and schematic. 115-230 V. 60 cps. Now $10.00

GYRO MOTOR ASSEMBLY
High speed 12 volt D.C. motor has heavy flywheel on shaft protected by metal enclosure. Removed from ... Only $1.19

COMMAND RECEIVER IF TRANSFORMERS
1415 Kc. Set of three ... Now $1.00
BC-453 AM/SCR-274N ... Now $1.00

BATTERY CHARGING PANEL TYPE BD-61
Has 0-5 and 0-15 Amps. D.C. and 3 to 7 and 0-30 Volts D.C. meters. 3 Rheostats. W.E. Rated 12-30 ohms at 3.75-15 Amps. 0 to 5 to 30 Amp. magnetic circuit breakers, and two automatic switches. Mounted in heavy gauge steel cabinet with hinged doors. Size 22" x 22" x 11" deep. Wt. Appr. 100 lbs. ... Now $19.50

ARC 5 COMMAND TRANSMITTERS
T-19 3 Mc. to 4 Mc. ... $19.95
T-18 4 Mc. to 5.3 Mc. ... $21.50
Note: Antenna loops & vibrators ... $3.95

DYNAMOTORS—PE-86
Input: 28V D.C. @ 13.5A Output: 2300 V.D.C. @ 60 Ma. New—with matched filter unit & spare set of brushes ... $3.95

CARBON MICROPHONE UNITS
W.E. 4-1 ... $0.98
Kellogg ... 95
Used, good condition.

HEADSETS
Military Type, 2000 Ohms Imp. 8 ft. rubber cord with Plug ... $2.19

PILOT LAMPS (Special)
3 V. Green or White ... 7 for $1.00
24 V. Switchboard Type W.E. 44-A ... 23c ea. 5 for $1.00
28 V. Type 313 Bayonet ... 13c ea. 8 for $1.00
Neon Type NE-2 1/2 W. ... 9c ea. 12 for $1.00
Material subject to prior sale. 25% dep. with all orders. Bal. C.O.D. Orders received less postage, shipped express. Minimum order $3.00.

FOREST SALES CO., Inc.
703 MADISON ST. EV. 6-1003 OAK PARK, ILL.

it will have no effect on the music. However, it will result in a tremendous decrease in the high-frequency and low-frequency noise, whose levels are well above the threshold of hearing. Of course, as the sound levels change, the cut-off frequencies will change correspondingly. A filter of this sort whose cut-off frequencies are controlled by the level of the reproduced sound forms the basis of the dynamic noise suppressor. Although it is extremely difficult to evaluate the degree of noise reduction resulting from such a circuit, it may be estimated to be in the neighborhood of approximately 20 db.

The circuit of a simple noise suppressor of this type is shown in Fig. 11. The audio signal is passed through a single section of low-pass and a single section of high-pass filter, each of which has a reactance tube forming one of its components. It is also amplified in an auxiliary amplifier whose output is rectified in two diode detectors to give a d.c. voltage proportional to signal level. These voltages are then filtered and applied to the control grids of the reactance tubes to control the cut-offs to the frequencies required by the signal level.

This circuit may be used either alone in the channel, or as part of a more elaborate preamplifier and tone-control unit.

(*To be continued*)

What's New in Radio

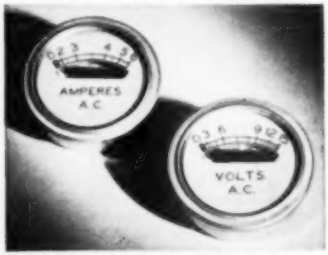
(*Continued from page 94*)

cartridge assemblies which are mounted back-to-back on a common plate. A unique switching device is used in the turnover mechanism. As the turnover knob is operated, the cartridge or side which has been in the playing position automatically disconnects and the side to be used makes connection with the amplifier phonograph input.

Output of the new "Twin CAC" is .8 volt at 1 kc. on the *Audiotone* 78-1 test record and .7 volt on the *RCA* 12-5-31-V. The frequency range is 30 to 11,000 cycles.

SMALL METERS

Sterling Mfg. Co., 9212 Detroit Avenue, Cleveland, Ohio, is in production



on a newly designed, small-sized indication meter which is approximately 40% smaller than former models.

WANTED! WANTED!

MILITARY TEST SETS & EQUIPMENT

TS-12, 13, 35, 14, 15, 146, 174, 175, 263, 268, etc. APR, ARC, ART, APS, APA, SCR, BC equipment and parts. Also TUBES, any quantity. WRITE, WIRE OR CALL.

R·H·S

SPECIALS OF THE MONTH

Coaxial Relay K-101 SPDT—24v DC's	$ 4.95
Set of 65 UHF Coax Connectors for Above	1.35
1000 Kc Crystal HT cut	3.00
VN-2 Vacuum Switch	9.95
Sigma Plate Relay 4000 ohm SPDT	2.49
BC-221 L Output Coil—75 ohm	
150" roll ..... $11.95 ..... 300' roll	22.50
3" Flange Shield	1.39
2000-0-2000 V @ 800 MA Xformer	24.95
15 HY @ 800 MA Choke	6.95
2 mfd 3000 V Condenser	4.25

TUBES!! BRAND NEW! STANDARD BRANDS! NO SECONDS! COMPARE! TUBES!!

0A3/VR75	$1.69	5C24	$2.25	21TC	$6.95	812H	$6.50	8005	$7.95	WL616	$37.50
0B3/VR90	1.29	5C25	4.95	22TA 5G2T	5.95	813	9.95	8008	1.75	WL617	19.95
0C3/VR105	1.49	5C31 C1B	3.49	240S	1.95	814	3.95	8012	3.95	WL673	30.50
0D3/VR150	1.49	5CP1	15.95	250R	12.95	815	3.95	8013	3.95	WL681	22.50
1B22	3.49	5CP1	2.25	250TH	32.50	816	1.30	8014	20.95	OA2	1.95
1B23	12.95	5DP1B1	4.95	250TL	21.50	826	1.29	8025	1.95	OA4G	1.80
1B24	19.95	5DP1B1	4.95	274A	5.50	828	12.75	8025	5.95	OB2	9.65
1B26	3.95	5DP1A	6.95	274B	2.69	829	12.95	8031	2.25	OZ4	75
1B27	24.50	5DP1A/2A	6.95	276A	2.95	832	12.95	8032	2.25	OZ4A	75
1B78	2.75	5D21A	1.98	280B	3.95	832A	12.95	8033	3.25	1A3	1.25
1B12	2.95	5E29	14.95	281	3.95	833	12.95	8034	1.49	1AF	1.75
1B35	24.95	5FP7	3.95	300B	6.95	833A	12.95	8035	2.95	1AG5T	79
1B40	12.95	5FP7	3.95	304TH	14.50	836	4.95	8036	1.49	1AH5T	79
1N21 Xtal	1.25	5HP7	3.95	304TL	14.95	836A	3.95	8038	1.49	1AJ5T	79
1N21A	8.25	4-65A	14.81	305A	34.95	837	1.09	8039	9.95	1AR5	80
1N21B "	6.25	4-125A	29.95	307A	DK75	5.95	841	1.09	8042	8016	1.49
1N22 "	3.25	4-250A	29.95	310A		8.95	841	1.49	CBJ	0.95	1B4
1N23 "	2.25	4AP10		311A			842	1.49	CK500D	9.95	1B4
1N23A "	3.25	4D21/E150	9.95	323A/B		24.50	845	4.95	CK502AX	3.25	1B5
1N23B "	6.25	4D24/E130	7.95	324A/B	5C37	4.95	849	39.50	CK503AX	2.25	1B5
1N26 "	6.95	4D32/HF	7.95	328A		49.50	851	29.50	CK505AX	2.25	1C5
1N27 "	1.00	4E27/2000	8.95	331A		12.95	852	29.95	CK506AX	2.25	1C7
1N34A "	1.00	4E27	8.95	348A		6.95	860	3.95	CK511AX	2.25	1D5GP
1P21	3.95	4K35	9.95	350B		4.95	861	29.50	CK512AX	2.25	1D7G
1P22	3.95	4C/CV92	24.95	368AS		4.95	864	1.49	CK513AX	2.25	1E5GT
1P26	2.95	4C27	24.50	371A		1.49	865	1.45	CK1005	3.25	1F5GT
1R21	6.95	4E27	25TH17	388A		1.95	866A	1.29	CK1006	3.25	1F7G
2AP1	1.95	5AP1		388A		2.75	866JR	1.29	CK1007	3.25	1F8
2C21 BK33	.69	5AP4		393A		6.95	869B	49.50	EF50	1.95	1F5G
2C22/7193	.69	5BP1		394A		6.95	872A	1.49	FG17A	8.95	1G4
2C26A	.49	5BP4		417A		12.95	874	1.49	FG57A	32.50	1G6GT
2C34 RK34	.69	5CP1		417A		4.95	876	1.49	FG81A	32.50	1H5GT
2C39	24.50	5CP7		446A		4.95	884	2.25	FG95	37.50	1H6GT
2C40	12.95	5C22		446B		4.95	885	2.25	FG105	79.50	1H6GT
2C43	14.95	5C22		450TH		47.50	905	3.95	FG117	79.50	1J6G
2C44	1.49	5FP7		450TL		47.50	905	3.95	FG237A	9.75	1L4
2C45	7.50	5JP1		702A		10.50	908	3.95	FG272A	20.00	1L4A
2C51	6.95	5JP1		559		1.39	908	3.95	FG237	14.95	1LA6
2D21	1.95	5JP2		700A		12.50	909	12.95	FG237A	14.95	1LB6
2E22	1.98	5JP2		703A		13.98	918	1.95	FG105	32.50	1LC5
2E24	4.88	5J23		703A		3.95	922	1.95	FG172	34.50	1LD5
2E25	4.88	5J26		703A		3.95	922	1.95	FG333	4.95	1LE3
2E30	2.29	5J30		703A		7.95	923	1.95	FG434A	4.95	1LE3
2J21/A	9.95	5J32		705A		2.95	927	1.95	FG1A	4.95	1LH4
2J22	9.95	5JP1		705A		2.95	930	1.29	FG502A	1.95	1LH4
2J26	29.50	5NP1		706BY		39.50	931A	4.95	FG590	14.95	1LN5
2J27	29.50	5AS6		706GY		39.50	954	4.95	FG590	14.95	1N5GT
2J30	99.50	6C21		706FY		42.50	955	4.95	GL502	1.95	1Q5GT
2J31	99.50	6J4		706DY		42.50	956	4.95	GL866	1.95	1R4
2J32	39.50	6J4		707B		17.98	957	4.95	HF100	10.95	1R4
2J33	39.50	6J5		708A		4.95	958	4.95	HY115		1S4
2J34	39.50	7DP4		709A		3.98	959	4.95	HY115		1S5
2J36	97.50	9DP7		710A		3.98	9011	NE16	HY615		1T4
2J37	12.75	9DP7		713		1.48	1603	3.25	HY615		1T5GT
2J38	12.75	9JP1		714AY		6.00	1613	2.25	KU610	37.50	1U4
2J39	12.75	9JP1		715A		3.95	1614	2.25	KU810	0.95	1U4
2J40	39.50	10BP4		715B		6.75	1616	2.95	IC4	60.00	1U5
2J41	39.50	10		717A		1.69	1622	3.25	HR21	3.95	1X2
2J48	39.50	10		717A		1.69	1622	3.25	HR35	4.49	2A3
2J49	39.50	12DP7		723A		2.95	1624	2.95	HR43		2A5
2J50	39.50	12GP7		723A		2.98	1625	4.95	HR53		2A5
2J54	39.50	12HP7		723A		14.95	1626	4.95	HR18A	4.49	2A7
2J55	39.50	12LP4		723A/B		32.50	1629	4.95	HR60	2.25	2A7
2J61	49.50	15R		724B		3.95	1630	1.98	HK60/1641	2.25	2B7
2J62	49.50	15R		725A		3.98	1631	1.98	HK654	24.75	2C5
2K25		16AP4		750A		42.50	1632	7.95	HN2		2C5
		16CP4		750TH		6.95	1633	7.95	HN2A		2C5
	723AB 29.50	19T8		750TL		20.95	1634	7.95	HN31		2C5
2K26	24.50	20T8		730A		2.90	1634	7.95	HN31A		2C5
2K39	24.50	23G4		805		50.00	1635	7.95	HN32		2C5
2K53	24.50	23G4		750TL		79.50	1636	3.25	HN32A		2C5
2K33	310.00	30 Special		805		19.95	1638	3.25	HR120		2C5
3AP1	12.95	35TG		801A		4.95	1641	2.95	HR120		2C5
3B22	2.95	45 Special				.49	1641	2.25	VR78		2C5
3B22 Elec	2.95	45Z5		802		4.49	1642	3.95	VR91		2C5
3B23 BK22	4.85	53A		803		4.49	1654	2.39	VR92		2C5
3B24	9.95	75TL		804		4.95	1655	1.98	VT127A		2C5
3B24W	9.95	100R				.89	1663	1.45	VT501		2C5
3B25	4.85	100TH		805		6.49	1851	1.49	VU39		2C5
3B26	7.95	121A		808		2.98	1851	1.49	VU111		2C5
3B27	3.95	203A		809		8.95	1960	1.49	WL417		2C5
3B28	8.95	204A		809		7.25	1961	4.99	WL468		2C5
3BP1	8.95	211		810		2.45	2050	1.90	WL530		2C5
3C22	64.50	212E		811		1.98	2051	1.45	WL531		2C5
3C23	9.95	215A		812		3.25	5670	9.95	WL532		2C5
							9005	9.95	WL578		2C5

5Y4G	$0.71	6H7GT	$0.90	12H7	$1.05
6A3	.89	6N7GT	.98	12SN7	.98
6AG5	.79	6P7GT	.85	12SR7	.85
6AL5	1.25	6S7	.95	12Z3	.85
6AQ5	.85	6S7GT	1.10	14A4	.95
6AT6	.89	6SU7GTY	2.19	14A7	.95
6AU6	.85	6T7G	1.25	14B6	.95
6B4	1.05	6T7G	1.20	14F7	.95
6BA7GT	1.20	6T8	1.18	14H8	.95
6BE6	.85	6U7G	.98	14N7	.95
6BD7GT	1.35	6U8GT	.98	14Q7	.95
6BG6G	2.25	6V6GT	.85	14R7	.95
6AF6G	.98	6V6	1.05	14S7	.95
6AG7	.95	6V6GT	.85	14W7	.95
6AG7	1.05	6W4	.85	19	.95
6AH6	1.60	6W7G	1.05	24A	.95
6AK5	1.50	6X4	.75	25A7GT	.95
6AK5	1.50	6X5GT	.75	25Z5	.79
6AL5	.82	6Y6G	.98	25Z6GT	1.05
6AQ5	.82	6Y7G	1.25	28	.50
6AS5	.97	7A4	.79	30	.95
6AT6	.97	7A4/XXI	.79	38DT	3.22
6AT6	.79	7A5	.95	41	.95
6AU6	.79	7A6	.85	42	.95
6AV6	.79	7A7	.85	43	.95
6AV6	1.25	7A7	.85	45Z3	.95
6B4	.95	7A8	.79	45Z5GT	.95
6B6G	.97	7B5	.79	50A5	.95
6B7	.79	7B6	.85	50B5	.95
6B8	.79	7B7	.85	50C5	.95
6BA6	.79	7C5	.85	50L6GT	.95
6BC5	.79	7C6	.85	50X6	.95
6BD6	.79	7E5	.85	53	.98
6BE6	.79	7F7	1.25	56	.98
6BF6	.79	7H7	.98	57	.95
6BG6G	.98	7J7	.98	58	.98
6BH6	.98	7K7	1.05	75	.95
6BN6	1.15	7L7	.98	76	.95
6BQ6GT	.98	7N7	.98	77	.95
6C4	.79	7S7	.98	78	.95
6C5	.79	7V7	1.05	80	.95
6C5GT	.79	7W7	1.05	82	.95
6C6	1.20	7X7	1.05	83	.95
6CB6	.79	7Y4	.79	84	.95
6D6	.79	7Z4	.79	85	.95
6E5	.79	9A8	.98	89	.95
6F5	.79	9AU7	.98	117L7GT	.98
6F6	.79	9BW6	.98	117M7	.98
6F7	.79	9BY6	.98	117N7	1.38
6F8G	.98	9CY5	.98	117P7	1.38
6G6G	.98	9DA6	.98	117Z3	.89
6H6	.79	12A6	.79	117Z6	.90
6H6GT	.79	12AT6	.79	128A7	.95
6H8	.79	12AU6	.79	128B7	.95
6J5	.79	12AU7	.98	128C7	.95
6J5GT	.79	12AV6	.79	128D7	.95
6J6	1.20	12AV7	.98	128F7	.95
6J7GT	1.25	12AX4GT	.98	128G7	.95
6K7GT	.89	12AX7	.98	128H7	.95
6K8GT	.98	12BA6	.79	128K7	.95
6L6	3.00	12BE6	.79	128L7	.95
6L6G	1.75	12BA6	.85	70L7	.95
6L6GA	1.75	12BH7	.98	71A	.79
6L7G	.98	12C8	.79	1B3	1.25
6N7	.89	12F5GT	.79	76	.95
6N7	.89	12H6	.79	77	.95
6R7	.85	12J5GT	.85	78	.79
6S7G	.98	12J7GT	.82	80	.73
6S8GT	1.05	12K7GT	.79	82	.89
6SA7	.85	12K8	.89	83	1.15
6SC7	1.30	12Q7	.89	83V	1.19
6SD7GT	.98	12SA7GT	.98	211/6Z4	.85
6SF5	.89	12SC7	.98	85	.89
6SF5GT	.89	12SF7	.98	80Y	.49
6SH7	.98	12SF7	.89	1617/M7	1.38
6SG7	.98	12SG7	.79	1117N7	1.38
6SJ7	.89	12SH7	.79	1117P7	1.38
6SK7	.89	12SJ7	.79	1117Z3	.89
6SN7	.89	12SK7	.98	1117Z6	.90

RADAR—COMMUNICATIONS—TEST EQUIPMENT

AN APA10 Panoramic Adapter $175.00
AN APA11 Pulse Analyzer .....
AN APR-4B Receiver 39.95
AN APR4 Radar Search Receiver .....
AN APS5 Radar Search Rec. 1000-3,100 mcs. 375.00
AN APS3 Airborne X-Band Search Radar 875.00
AN APS25 X-Band Rdr. 95.00
AN APTS 300-1500 mcs Xmitter 149.50
AN CRT3 Dual Freq Vertical Gdr. 129.50
Complete **YJ Beacon** Installation 19.95
AN PPN-1 Portable Radar Beacon .....
BC221AK Freq. Mtr. with Modulation 149.50
BC-433G Compass Receiver 39.95
BC-639 Receiver 285.00
BC-640B 100-156 mcs ground xmitter 1300.00
BC-733D Receiver 29.95
BC-1016 Tape Code Recorder 495.50
BC-1206 Beacon Receiver 6.95
MN26Y Compass Receiver 24.95
PE-75 21/2KW Gasoline Generators 450.00
RA-34 Power Supply 250.00
SCR269G Automatic Radio Compass 129.95
SCR504 Portable D.F. 100 Kc-65Mc .....
SCR522 Airborne VHF Transceiver .....
SCR536 Handi-Talkie .....
SCR694 Lightweight Field Radio .....
SR-1M Radar Receiver Indicator 89.50
SQ Portable Radar 10 CM. 850.00
T-50 Portable Radiotelegraph Xmitter 275.00
TCS Marine 2 Way Radio .....
TRC-1 Complete Antenna System .....
RA-62 Power Supply for SCR-522 .....
MD-5 APS-3 Modulators with Tubes 65.00

ARA 500-1500Kc Receiver, good $24.95
R28 ARC-5 Receiver 29.95
BC455B 6.6 mcs. Receiver 19.95
BC433 200-1750Kc Compass Rec. 19.95
ARB-2 234-258 mcs. Receiver 19.95
BC-454 3.6 mcs Receiver, New 14.95
T23 ARC-5 Xmitter 49.95
BC-459-A 3.6 mcs Xmitter 29.95
TYPE O 5.3-7 mcs Xmitter 9.95
BC-457 7.3-9.1 mcs Xmitter 29.95
BC-191 300-13,000Kc Complete, New 79.50
BC-958A 1100-1300 mcs Xmitter, New 19.95
BC-456 Modulator, good 2.25
BC-450 Control Box, Rec. used 1.25
BC-451 Control Box, Xmitter, used ..... .98
BC-442 Relay Unit Ant. Used 1.95

FLEXIBLE SHAFTING AVAILABLE.

HRU-38 28V 2000W Gasoline Generator .....
RG-8U Coaxial Cable. Per Thousand Feet $85.00
SCR-518 Attenuator. Complete Installation 29.95
SCR-522 Trans./Rec. Complete installation 28V input 12V input avail. 129.50
RCA Sound Powered Chest & Headsets. Pair 29.95
LARGE QUANTITY PE-104 VIBRAPACK FOR SCR-284 NEW EXPORT PACKED.
HS-30 Headsets 3.98
FT-154 BC-348 Shock Mount 2.98
HS-33 Headsets 4.95
BC-906 Automatic Keyer for SCR522 ..... 9.95
BC1284 Lighthouse Tube Preamplifier 69.95
APA-17 D.F. Antenna, 300-1000 Mc 89.00
BC-906 Interphone Amplifier 9.95
ART-13 Loading Condenser .....
CU-25 Loading Box for ART-13 ..... 49.95
AS-27 ARNS Antenna 4.95
SA-1 ARN-5 ..... 2.95
19-80 APA-17 Indicator 129.95
BM-29 Remote Control 14.95
BA-300 FM Exciter 32.50
A-55 Dummy Antenna 2.25
BC-1305 Control Box 3.95
FL-6 Filter 3.95
FL-8 Filter less Cables 2.69
BC-1161 OSAP Test Set, Complete 19.95
AT-2 APN-2 Antenna 4.95
CS-172 173/CPN-8 10CM Patch Cable 4.95

TS3 AP S-Band Freq & Power Meter .....
TS10 APN Altimeter Test Set, Rx $39.00
TS11 AP .....
TS12 AP V.S.W.R. Test Set for X-Band .....
TS13 AP XA Band Sig Gen Pwr & Freq Mtr. .....
TS14 AP SA Band Sig Gen. .....
TS15 AP Test Meter .....
TS16AP Altimeter Test Set $29.95
TS19 APQS Range Calibrator .....
TS31 APN Test Set for SCR718 Altimeter .....
TS32 TSC-1 To 100 mcs Sig Gen used to check ANTRAC Equipment .....
TS33 AP X-Band Freq. Meter .....
TS34 AP Synchroscope .....
TS35 AP X-Band Sig Gen Pwr Mtr Freq Mtr. .....
TS36 AP X-Band Power Meter .....
TS45 AP X-Band Sig Gen .....
TS55 AP Test Set Complete Mtrs. .....
TS55 APN Altimeter Test Set .....
TS61 AP S-Band Echo Box $140.00
TS62 AP X-Band Echo Box .....
TS67 AP I.I.S. Test Set .....
TS69 AP Freq. Mtr. 300-1000 mcs $72.50
TS89 AP Voltage Divider .....
TS102 AP Range Calibrator .....
TS110 AP Echo Box .....
TS111 AP S-Band Freq. Meter .....
TS125 AP S-Band Power Meter .....
TS126 AP Synchroscope .....
TS135 UP S-Band Sig Gen Pwr Mtr Freq. Mtr. .....
TS164 AS A.C. Version of BC221 .....
TS170 ARN I.I.S. Test Set .....
TS174 AP Freq. Mtr. 40-400 Mcs $395.00
TS175 AP Freq. Mtr. 300-1000 mcs. .....
TS184 AP .....
TS185 AP .....
TS226 AP 300-1000 mcs Pwr Mtr. .....
TS268 AP Xtal Diode Test Set. .....
TS278 AP AN APS13 Test Set. .....
BC-221 Frequency Meter .....
1E-19 Test Set for SCR-522 .....
1E-36 Test Set for SCR522. .....

AN/ARR-2X RECEIVER

Secret Transmission Receiver for reception of double modulated carrier. Will receive 235-248 mcs. signals that have been modulated by a 600-750 K.C. signal. When carrier is heard on a standard receiver no modulation is heard on the carrier when actually speech is being transmitted. 12V DC input. Excellent condition.

SO-13 S-BAND MARINE RADAR

Compact Sea Search Radar for small vessels. P.P.I. Indicators is provided. Complete in original crates with complete sets of spares. Excellent condition.

AN/ARC-1 TRANS/REC.

Provides Radio-Telephone Communication between Aircraft or Aircraft & Ground. Complete with Shock Mount & Control Box. Input 28V DC. Excellent condition. Available in either 10 or 20 Crystal Controlled Channels 100-156 MCS. checked out.

TELETYPEWRITER SERVICE NY1-771

We now offer this convenience to our customers. Send your requests and orders for tubes, equipment, test sets, parts, etc., to NY1-771.

RADIO HAM SHACK Inc.

189 GREENWICH STREET . NEW YORK, N. Y.

PHONE DIGBY 9-0347

Cable Address: Hamshack New York

Prices subject to change without notice. F.O.B. NYC, minimum order $10.00. 20% deposit required. All merchandise guaranteed.

LOW FREQUENCY CRYSTALS

FT-243 (Bomb). Holders. Channel spacing 1.050 kc. All frequencies in kilocycles. **80c ea.**

175	440	277	430	555	650	333	486
176	500	404	166	556	111	467	500
177	777	405	555	433	333	467	111
178	666	406	944	434	111	468	000
180	555	406	333	436	111	467	679
181	444	406	722	437	555	468	444
183	333	411	111	438	000	466	666
184	722	412	5	439	444	467	222
185	111	414	444	440	000	468	444
187	5	415	277	443	055	470	833
188	000	416	666	444	722	471	777
190	277	416	055	445	611	471	055
191	833	419	444	446	500	472	333
193	055	420	833	446	611	475	166
194	722	421	611	447	277	475	555
196	611	422	611	451	055	475	944
197	222	425	00	452	777	480	555
198	666	426	388	454	444	481	666
400	00	427	777	455	555	482	333
401	166	429	166	456	944	484	722

511	000	555	650	333	486	111	511
512	166	556	111	467	500	515	277
513	555	433	333	467	111	488	000
514	944	434	111	468	000	477	277
515	333	436	111	467	679	491	666
516	722	437	555	468	444	491	944
517	111	438	000	466	666	494	444
518	5	439	444	467	222	495	00
519	444	440	000	468	444	497	222
520	277	443	055	470	833	498	611
521	666	444	722	471	777	499	388
522	611	445	611	471	055	501	166
523	055	446	500	472	333	502	777
524	833	446	611	475	166	504	166
525	722	447	277	475	555	505	555
526	611	451	055	475	944	506	944
527	00	452	777	480	555	508	333
528	388	454	444	481	666	509	111
529	166	455	555	482	333	511	111
530	944	456	944	484	722	512	5

Power Supply for Any 274-N Receiver



Just plug it into the rear of your 274-N RECEIVER . . . any model. Complete kit and black metal case, with ALL parts and diagrams. Simple and easy to build in a jiffy. Delivers 24 volts plus B voltage. No wiring changes to be made. Designed especially for the 274-N receiver. **All necessary parts for conversion of rest of receiver also included. ONLY $8.95.**

CONDENSER TESTER



● One of our best sellers. Useful, versatile laboratory item. 16 kit form, simple and easy to build in less than an hour. Checks condenser leakage and continuity up to 8 megs. Will test any paper, electrolytic, mica or oil capacities from 50 mmf. to 50 mfd. Self-contained power supply and neon bulb indicator with socket and bezel. Drilled metal cabinet. Complete instructions and diagrams included with each kit . . . only **$5.00.**

U-V LIGHT SOURCE

A watt ultra-violet light source. In kit form including Sylvania black light tube. (The U-V light is the 3660 Angstrom unit region) ballast, starter, mounting panel, reflector, line cord/plug, hardware, instructions. An invaluable device for lab, info, service shops, home workshop, etc. Here is a genuine value.

Complete kit, (less outer housing) . . . only **$4.95**

TU-100 Tuning units. This is the hi-freq. tuning unit with the excellent variable condensers as well as loads of inices, coils, worm drive, etc. Only **$1.75** ea.

LOOK! NO HANDS!



This mike leaves both hands free for mobile QSO's. Fastens to operator by simple snap strap. Adjustable. Double action sw. operates push-to-talk or holds on. Only **$2.89** ea. POSTPAID in U.S.A. and CANADA.

NEW PHONE PATCH

Now redesigned into more compact and convenient housing, the 2 6000's phone patch retains all of its excellent characteristics. Provides you with exactly what you need to patch your phone into transmitter or receiver. Features include hi impedance input suitable for 'all' mike and both hi and low impedance inputs to insure proper match to your particular receiver. Unit is complete . . . "Store-line" ready to go to work for you. Only . . . **$4.95** ea.

TRANSFORMERS-CHOKES:

5V. 25A. Pri. 115V. 60 cy. AC. A real rugged job excellent for 304TL—4-250A etc. Limited quantity. Only **$4.50** ea.

100, 200 ma. choke. Hermetically-sealed steel case. Also has bow-bucking tap. A beautiful item only **$1.98.**

Power Transf. 350-0-350 @ 70 ma. 5V @ 3A. 6.3 @ 3A. Pri. 110V. 60 cy. AC. Upright mtg. **$3.25** ea.

Power transf. Pri. 115V, AC, 60 cy. Sec. 320-0-320 @ 200 ma. **$5.25** ea.

350-0-350 @ 300 ma. 6.3 @ 4A. 6.3 @ 8A. 5V @ 3A. Pri. 115V. 60 cy AC . . . only **$7.95** ea.

450-0-450 @ 200 ma. Pri. 115V. 60 cy. AC. 5V @ 3A. 6.3 @ 5 amp. In shielded case. Only **$8.90** ea.

350-0-350 @ 250 ma. 6.3 @ 10A. 5V @ 6A Pri. 115V. 60 cycle. Only . . . **$8.95** ea.

Minimum order $2.00. All items subject to prior sale. All prices subject to change without notice. 20% deposit must accompany all orders, balance C.O.D.

OFFENBACH & REIMUS CO.

1564 MARKET ST.
SAN FRANCISCO, CALIF.

The new meter fits a 1⅝" mounting hole while a back panel clearance of 1" from the flange is needed. These meters are available in ranges of 1 to 50 volts, 1 to 30 amperes, and 10 to 100 ma. They are designed to give a reading accuracy of 5 per-cent at any given point on the scale with a 10 per-cent over-all accuracy. Both a.c. and d.c. models are available.

HANDY SCREWDRIVER

Continental Screw Company, New Bedford, Massachusetts, is distributing



an ingenious and handy screwdriver which features removable low-cost *Phillips* insert bits for driving screws with *Phillips* recessed heads.

Designed to be used on the factory line or in the home workshop, the new screwdriver takes interchangeable bits. When one wears out it can easily be removed and replaced. Four different sizes of bits are available but the #2 size will drive from 75 to 80 per-cent of all screws with *Phillips* recessed-type heads.

AUDIO OSCILLATOR

Waveforms, Inc., 333 Sixth Avenue, New York 14, New York, is now marketing an extended range audio oscillator, the Model 510-B.

Small in size, the new instrument has a frequency coverage of from 18 cycles to 1.2 mc. in five overlapping ranges, low distortion (less than .2 per-cent over most of the useful range), constant output ± .5 db from 18 cycles to 100 kc., calibrated output voltage, 300 degree vernier-drive dial, and accuracy and stability ± 2 per-cent ±



1 cycle for all conditions of line voltage variation (± 10 volts) to 210 kc.

The TURNTABLE is the HEART OF YOUR HIGH FIDELITY SYSTEM

You may own the finest pickup, amplifier and speaker that money can buy . . . yet you'll get poor reproduction if your TURNTABLE has excessive wow, hum or rumble!

Rek-O-Kut offers a complete range of 12" Turntable models to match your present high-fidelity equipment and your own pocketbook. Not every sound system requires the most expensive turntable . . . your turntable must be chosen to complement your other components. Each REK-O-KUT Turntable carries an engineering specification which enables you to select the appropriate unit to match your other components. Quality and workmanship of every REK-O-KUT Turntable is identical . . . price differential depends solely on type of materials used.



MODEL LP-743
3-Speed 12" Turntable

Induction type motor, designed for smooth, vibration-free operation. Instantaneous speed changes without stopping turntable or removing disc. ..... **$54.95 Net**

MODELS T-12M & T-43M — 2-Speed 12" Turntables

Recommended for use with ULTRA HIGH FIDELITY Amplifiers and Speaker Systems. The only 12" Turntable that meets N.A.B. specifications for speed regulations and Wow content.

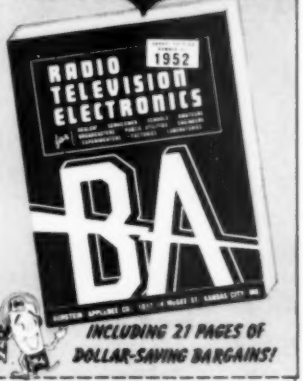
MODELS	MOTOR	RB Noise Level	SPEED	PRICE
T-12 M*	Hysteresis Synchronous	-50DB	78-33⅓	$119.95
T-43 M*	Hysteresis Synchronous	-50DB	45-33⅓	$119.95
T-12	4 Pole Induction	-40DB	78-33⅓	$84.95
T-43	4 Pole Induction	-40DB	45-33⅓	$84.95

*Delivery limited due to short supply of Hysteresis motors.

REK-O-KUT CO.
38-03 Queens Blvd., Long Island City, N.Y.
EXPORT DIVISION: 458 Broadway, New York City 13, U.S.A.
CANADIAN: RACKE-KUT CORP., 1000 King St. W., Toronto 1, Ontario

DID YOU GET IT? IF NOT

SEND NOW FOR B-A's 136 BIG PAGE FREE CATALOG



INCLUDING 21 PAGES OF DOLLAR-SAVING BARGAINS!

BURSTEIN-APPLEBEE CO.
1012-14 McGee St.
Kansas City 6, Mo.

FREE

Send your 1952 catalog to:

Name .....

Address .....

City ..... State .....

BURSTEIN-APPLEBEE CO.

The entire unit measures 6" x 4¼" x 5¼". A type T-10 matching transformer is available for operation with balanced output permitting its use on balanced lines.

SPRAGUE FEEDTHROUGHS

Sprague Electric Company, North Adams, Massachusetts has announced the availability of a new feedthrough ceramic condenser for filtering leads passing through a chassis or shield partition.

The Type 503C has the small ceramic disc element resin-sealed in a recessed cup at the top of the metal ferrule in order to provide maximum protection against humidity. The through-lead passes through a hole in the center of this dielectric disc. Thus, there is equal radial distribution to the grounded outer shell for all high frequencies being bypassed resulting in low inductance.

Rated at 50 volts d.c., capacitance values of the new units range up to 100 μfd.

Full details on the Type 503C are contained in the company's Engineering Bulletin 605 which is available to interested persons on letterhead request.

TRIPLETT SCOPE

The Triplett Electrical Instrument Co. of Bluffton, Ohio, is currently introducing a new 5" oscilloscope which



has been designed for TV, FM, and a variety of industrial testing applications.

The Model 3441 features an illuminated calibration meter which makes it possible to view the percentage of positive and negative peak-to-peak volts in addition to reading peak-to-peak voltage directly in 8 ranges from 0 to 1000 volts. The frequency range of the horizontal amplifier is flat within ± 20 per-cent from 20 cycles to 150 kc., deflection sensitivity is .15 rms volt/inch. The response of the vertical amplifier is usable to beyond 4 megacycles.

The unit is furnished in a black suede-finished metal case which measures 15 11/32" x 11 11/32" x 16". Accessories include coaxial cables, a probe, and instruction booklet. A crystal signal tracing probe is available as an extra accessory and adapts the unit for a variety of r.f. uses. —30—

Announcing

ADVANCED SERIES 400 RECORDERS

MODEL 400-A *with* Half-Track Head

•

MODEL 401-A *with* Full-Track Head

•

15 & 7 1/2 Inches Per Sec.



Full REMOTE CONTROL

Solenoid operated mechanisms for all mechanical motions.

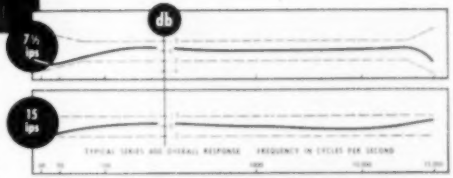
also *Featuring*

- UNIFORM RESPONSE . . . to 15,000 cps at 7½ ins. per sec.
- LOW NOISE & DISTORTION LEVEL . . . signal-to-noise ratio over 55 db at either tape speed (as defined by NARTB).
- PUSH BUTTON OPERATION
- LONG LIFE . . . precision built.
- LOW MAINTENANCE . . . even with continuous use.



4 to 1 TAPE SAVING

The valuable tape saving ability of Series 400 Recorders is clearly illustrated above — the young lady holds four reels which contain the identical program formerly requiring the sixteen reels shown on table. No other recorder can give this remarkable tape saving because no other recorder is capable of 15,000 cycle performance at 7½ ins. per sec., on but half the width of the tape!



PERFORMANCE . . . beyond comparison!

Published specifications of Ampex Recorders are conservative as these typical check-out graphs on Series 400 show. Ampex check-outs always exceed guaranteed performance but even the guaranteed performance is sufficient to make Ampex the world's finest recorder!

INTERCHANGEABILITY OF TAPES . . . another unrivalled superiority of Ampex. This means that recordings made on any Ampex can be played back on any other Ampex (of like speed) with identical high fidelity and timing.

PORTABLE IN SINGLE CASE or for RACK MOUNTING



ASK FOR BULLETIN A-211

. . . gives complete description and specifications of the Series 400 Ampex Magnetic Tape Recorders.

AMPEX

AMPEX ELECTRIC CORPORATION
Redwood City, California

Distributors in Principal Cities

Magnetic RECORDERS

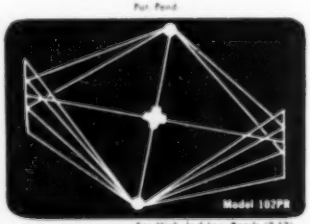


WITH THE RHOMBIC

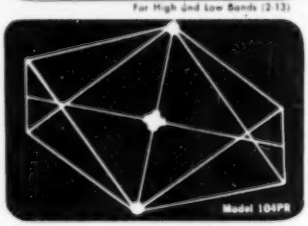
Phillips DX-er

Actually proven in field tests to have higher gain in fringe areas than any other antenna in use today.

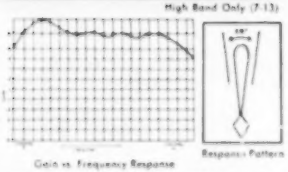
- NON-RESONANT... 14DB GAIN
- COMPLETE COVERAGE... CHANNELS 2–13
- REDUCES OR ENTIRELY ELIMINATES GHOSTS
- SHARP DIRECTIVITY... LOBE WIDTH 20°
- PRE-ASSEMBLED · WIND RESISTANT



For High and Low Bands (2-13)



High Band Only (7-13)



Gain vs. Frequency Response — Response Pattern

Write Today for Technical Literature on this Outstanding Rhombic Antenna.

Roger-Phillips
RESEARCH LABORATORIES
717-RM NO. LAKE AVE., PASADENA 6, CALIF.

"Pre-Fab" Tuners
(Continued from page 52)

for assembling the kit. The chassis is completely prepared, with all cut-outs and screw holes drilled so that no work with a file or drill is necessary.

Each circuit or assembly is mounted, wired, tested, and aligned at the factory, and the same tubes that are used during the test are included with the kit when it is shipped. This precludes the necessity of intricate alignment procedures when the proper test equipment is not available.

Some of the design features include a heavy-duty power transformer, with a 30% safety factor, which delivers 220 volts of plate voltage instead of the usual 250 to 275 volts. This allows the tuner to operate much "cooler," which adds to the stability, lengthens the life of the tubes, and generally provides better performance. Heavy filtering is used for the absolute minimum of hum.

Physically, the tuner is well proportioned. It measures only eight inches in depth and is but a fraction over six inches in height. The chassis is seventeen inches long and is equipped with a large, easy-to-read slide rule dial.

The FM tuning unit is extremely stable, making it unnecessary to use a.f.c. on the oscillator. Drift is barely noticeable three to five minutes after the tuner is switched on. By not using a.f.c., a greater degree of selectivity is achieved, which allows the full sensitivity to be realized. For example, tests in our laboratory showed that the tuner was able to completely separate two stations, one channel apart, with acceptable performance from each; the one having a signal strength of 5000 microvolts being fifteen miles away and the other having a signal strength of 20 microvolts, located at a distance of seventy miles from the receiving point.

The tuning unit was specially designed for the ultimate in performance at FM frequencies. Permeability tuning, known for its superior performance at high frequencies, is used in this unit. The electroplated glass coils and tuning cores are held within 1% tolerance. The oscillator operates 10.7 mc. higher in frequency than the signal circuits and its stability is exceptionally good.

The mixer, or converter stage, is of conventional design. The oscillator voltage is injected directly into the mixer grid through a 68 $\mu\mu$fd. ceramic condenser from the oscillator plate.

The r.f. stage employs a 6J6 dual triode in a grounded grid circuit. At very high frequencies this type of circuit offers considerable advantage over the more conventional pentode stage. The loading effect of the tube on the coils is many times less than a pentode at these frequencies. Consequently, the "Q" of the circuit is improved, which increases both the sensitivity and image ratio.

With these design features, excellent sensitivity has also been achieved. An average sensitivity of 6 to 10 microvolts is realized which often places FM stations, which heretofore were out of range, within reach.

I.F. Amplifier

To provide top performance, there was no skimping in the design of the i.f. amplifier. Six tubes are used: Three i.f. amplifiers, two limiters, and a discriminator type of detector. The operating frequency is 10.7 megacycles. Distortion measurements show less than ½ of 1% harmonic content, and the frequency range includes 20 to 20,000 cycles with a variation of only 2 db. The de-emphasis network uses a 500 $\mu\mu$fd. condenser with a 100,000 ohm resistor giving a time constant factor of 50 microseconds. Although the standard FM de-emphasis characteristic is 75 microseconds, it was felt that a little advantage on the high frequency end was desirable, due to capacity effects in shielded wires used to couple the tuner to the amplifying equipment.

A "Pre-Fab" tuner, in combination with one of the better audio amplifiers now being produced, leaves little to be desired from a reproduction standpoint. The design of this tuner had the home builder and audio enthusiast in mind in presenting this versatile chassis for all applications from the laboratory of the experimenter to the control panel of a radio station.

–30–

TV ANTENNA COUPLER

By WILBUR J. HANTZ

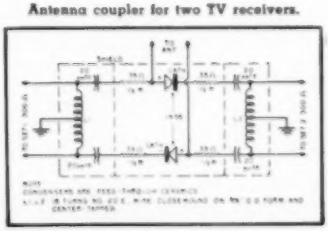
AFTER considerable experimenting to find some means of providing adequate isolation between television receivers when they are operated from the same antenna, I finally came up with the idea shown in the schematic.

In addition to providing a good impedance match between the two TV receivers and the transmission line, this gadget also prevents oscillator radiation from feeding back through the receivers. The 1N56 crystal diodes are strictly one-way devices as far as the signal is concerned but they present a very high impedance to any signal trying to come back from the receivers.

When constructing the unit, it is advisable to isolate each low-pass filter section in an individual can, grounded to each receiver's chassis. If the receivers are of the transformerless type, then ground through a 100 $\mu\mu$fd. mica condenser.

–30–

Antenna coupler for two TV receivers.



FOLDED LONG WIRES

By BOB PERTHEL, W9MWD

Solve the problem of feeding long lines without resorting to complicated matching or end feeding.

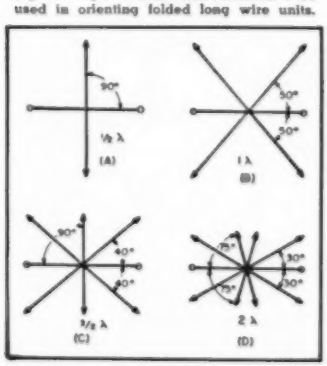
JUST what to do about an antenna for 20 meters if you can't put up a good beam because of space limitations has bothered me for some time just as I imagine it must be bothering other city dwelling hams, or those with cramped spaces.

The antenna I was using was a 20-meter half-wave doublet, with length determined by formula, fed with 50 feet of 75 ohm coax. Careful examination proved that great standing waves existed. Further observation led me to believe that the proximity of two houses and a tree were affecting the electrical length, and probably to a greater degree on one side of the feedline than the other.

A folded half-wave doublet could be expected to be broad tuning and, as a consequence, not affected as much by trees and houses. So up went a folded dipole, but a little more in the clear this time. It worked well, but only in two directions. It was observed during two months of operation that although the pattern was what might be expected locally, this did not hold true on skip and the only directions that could be worked consistently were directly broadside to the antenna. See Fig. 1A. Why a half wave should show such marked directional characteristics is probably because the vertical angles of the power radiated due to ground reflection vary throughout the normally expected pattern, but directly broadside to the antenna all desirable vertical angles are present in the pattern. Incidentally, this effect holds true for lobes of long wires.

The particular folded dipole that I used ran directly east and west, permitting reliable communication with only a few stations because of my central U.S. location. Since it was impossible to change the direction of the dipole, the possibility of using folded antennas of other than a half wave to obtain a different pattern was pondered. Folding a half-wave antenna broadens its resonance and multiplies its radiation resistance by a factor of 4. These characteristics hold true for folded antennas of other lengths too. The curve in Fig. 2 shows how radiation resistance varies with the length.

Fig. 1. Angles of maximum radiation to be used in orienting folded long wire units.



Folded antennas of 1, and 3/2 waves were tried at W9MWD and these, too, showed marked directional effects as shown by Figs. 1B and 1C. In addition to permitting operation in desirable directions these antennas also have a slight gain over a half-wave antenna.

Another nice thing about these antennas is that the lengths can be calculated by formula and fed with a flat line that requires no tuning, just link it to the final. On even harmonics these antennas can also be worked by using voltage feed and tuning the feed line in the conventional manner but, of course, with standing waves on the feedline and a different radiation pattern. When voltage-feeding an antenna of this sort its radiation pattern is difficult to predict as the waveforms on it may differ in regard to phase from what might normally be expected.

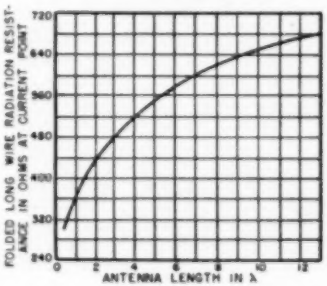


Fig. 2. Radiation resistance curve.

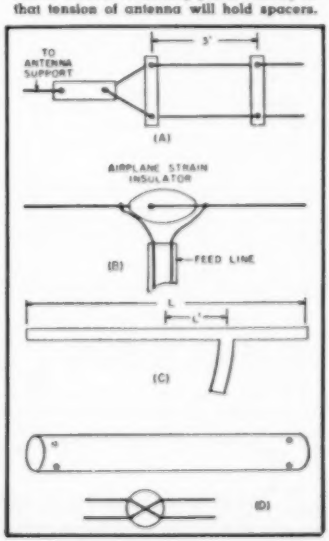
The folded antennas used at W9MWD were all for 20 meters and constructed of number 16 wire spaced 4 inches by 6-inch lengths of plastic tubing at 3-foot intervals. The insulation need not be the best and even wood would do. Plastic tubing was used only because it was the lightest material available. Regular 300-ohm line was used to feed these antennas, and it provided a satisfactory flat line in all cases. Open wire line could be constructed to match the impedance with less line loss but the line loss with 300-ohm line is so low that it wasn't considered worth the added effort. With folded antennas longer than 3/2 waves, an open wire line of the proper impedance should be constructed to prevent standing waves on the feed line. Since end effects occur only once, the formula, $L\ (feet) = 492\ (N-.05)/f\ (mc.)$, where N is the number of half-waves, must be used to determine the length. In order to current-feed these antennas properly, which can be at any convenient current loop, the fact that end effects occur only at the end must again be considered. Start at the center and using the free space formula $L\ (feet) = 492/2f\ (mc.)$ calculate the distance to the current loop.

There is no reason why folded long wire antennas couldn't be designed for use on any of the amateur bands with equal success, however different spacing of the antenna itself would probably be better than the 4 inches used on 20; 8 inches for 80 and 2 inches for 10 meters is suggested. Varying the spacing does not affect the radiation resistance of the antenna. The step-up in impedance is due to the current dividing between the two conductors of the antenna.

A folded full wave is in use at the present time on 14,206 kc. This antenna provides lobes through Central Europe, Eastern South America and Africa, Alaska, and Australia, and long 100% QSO's to all these places have become a reality with only 90 watts input to the transmitter on 20 meter fone.

—30—

Fig. 3. Construction details. Note that (D) shows method of drilling plastic tubing so that tension of antenna will hold spacers.





FOR PERFECTION

in TV INSTALLATIONS
in any locality use the new

Simpson MODEL 488
TV FIELD STRENGTH METER

Ideal for antenna orientation, comparison of antenna systems, adjustment of TV signal boosters, checking antenna and lead-in installations and many other functions . . . *the 50 microvolt full scale range is an outstanding feature for those concerned with fringe area installations where maximum efficiency must be attained* . . . the 500, 5,000 and 50,000 microvolt ranges extend the usefulness of the Simpson Model 488 into areas of higher signal strength.

SIMPSON ELECTRIC COMPANY
5200 WEST KINZIE STREET, CHICAGO 44, ILL.
Phone: COlumbus 1-1221
In Canada: Bach-Simpson, Ltd., London, Ontario

SHOOT TV TROUBLE FAST!

With H. G. Cisin's Copyrighted *RAPID* "TV TROUBLE SHOOTING METHOD"

Without experience or knowledge, this guaranteed new method of servicing TV sets enables you to DIAGNOSE TV troubles as rapidly as an expert. NO THEORY—NO MATH . . . you can locate all faults in record breaking time, regardless of make or model. The TROUBLE SHOOTING METHOD is the most valuable aid to TV servicing ever written. Be a TV Trouble Diagnostician. Increase your present earnings, open your own Profitable Business or get a high paying salried job.

It's all in this book . . .

Nothing more to Pay—Nothing else to Buy

Alphabetically listed, there are 85 picture troubles, over 36 raster and 11 sound troubles and by this unique copyrighted method you know EXACTLY WHERE the trouble is . . . plus step-by-step instructions, including 55 RAPID CHECKS, enabling you to find the faulty part.

11 IMPORTANT PRELIMINARY CHECKS NEED NO INSTRUMENTS! Of the 55 Rapid Checks, **OVER 65 ALSO REQUIRE NO INSTRUMENTS!** Rapid checks include emergency checks for distorted pictures, defective tubes including RIX tube, plus 57 others. **ALL EXPLAINED IN SIMPLE LANGUAGE. PERFORMED WITHOUT INSTRUMENTS. MANY CHECKS USE THE PICTURE TUBE AS A GUIDE.**

H. G. Cisin, the author, is the inventor of the AC-DC midget radio. He licenses RCA, AT&T, etc. He has also trained thousands of technicians now owning their own prospering TV service organizations or holding highly paid TV positions. His years of experience are embodied in this remarkable new TV TROUBLE SHOOTING METHOD.

Guaranteed: Money Back in 5 Days if Not Satisfied!

Send your name and address today with $1 for your postpaid copy; you'll say it's worth hundreds! $1 Postpaid

H. G. CISIN—CONSULTING ENGINEER
(Dept. N-5), 200 Clinton St., Brooklyn 2, N. Y.

Name .....
Address .....
City ..... Zone ..... State .....

FOR THE "GOLDEN EAR" CROWD

THE PFAN-TONE STRAIN-SENSITIVE PICKUP

Here's why this truly faithful reproducer appeals to people gifted with the "Golden Ear" . . . why the PFAN-TONE STRAIN-SENSITIVE PICKUP brings out the brilliance of great voices and orchestras . . . the latent music on your records that other pickups leave untouched.

- **The PFAN-TONE STRAIN-SENSITIVE PICKUP is an amplitude transducer with a CONSTANT RESISTANCE of about 250,000 ohms.**
- **Signal output is at a practically CONSTANT IMPEDANCE LEVEL.**
- **Excellent Transient Response.**
- **NO DISTORTION, phase shift or evidence of intermodulation is audible.**
- **LINEAR RESPONSE, free from peaks or resonances.**

Cartridges are available for both standard and micro-groove, and can be had with Famous PFANSTIEHL M47B Precious Metal Alloy or diamond tipped styli.

A special preamplifier is necessary to provide the correct D.C. voltage for the pickup element and to provide the first stages of signal gain. Four styles are ready, or, if you prefer, you can build you own from the circuit in the literature.

Ask your radio supply man, or write today for complete FREE INFORMATION.

PFANSTIEHL
CHEMICAL COMPANY
101 Lake View Avenue, Waukegan, Illinois

Speaker Enclosure

(Continued from page 49)

with a pencil draw the inside outline of the frame on the front piece.

Probably the neatest way to finish the enclosure is to paint it exactly the same color as the wall. If that is not possible or desirable, it can be painted some other color or an ambitious builder can put a furniture finish on it. Matching it to the wall, however, as was done here, makes it most unobtrusive and eliminates the necessity for furniture finish without giving the job a "homemade" look.

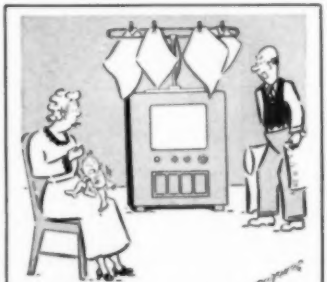
In any case, paint the area of the front that will be within the frame a dark color. Then when a cloth is put in the frame and the frame mounted, the outlines of the speaker holes will not show.

Lumite, a plastic cloth made especially for this purpose is ideal; it can be obtained from parts suppliers. Another cloth can be used, however, with the proviso that it should (*a*) not be soft and (*b*) have a very loose weave. Soft cloth will absorb highs and tight weaves will block off the sound. If in doubt, try sample pieces, placing them by hand in front of the speaker and then removing them. They should not alter the sound quality.

One hint for those not familiar with painting wood. Before painting apply a coat of shellac—very, very thin shellac—and let it dry for a couple of hours. This fills the wood so it does not absorb the paint and require several coats. The paint itself can be flat wall paint of good (not ordinary apartment-house) quality to match the wall exactly, but easier and better results are obtained with enamels such as the painter uses on doorframes and other woodwork. The enclosure in the photos was painted flat, however (three coats) and turned out nicely.

Mount the crossover network and any other parts such as the high-frequency volume control inside the enclosure on the front panel or perhaps on the woofer frame. Lead the audio line out through a small hole at one bottom corner of the front piece.

The lady of the house should now be properly impressed. —30—



"I keep telling you, Madge . . . that antenna is a dipole, not a didy-pole!"

Crystal Diodes

(Continued from page 57)

age the tube is cut off. Thus the sync pulses will always cut off the picture and variations in signal strength will always adjust automatically to this condition. An attempt is made to help you visualize what happens in the diagram of Fig. 3B.

Fig. 4 shows a comparative set of current-voltage curves for the 1N34, 1N65, and ½ a 6AL5. The slopes of the crystal diode characteristics are materially greater than the slope of the 6AL5 characteristic at any com-

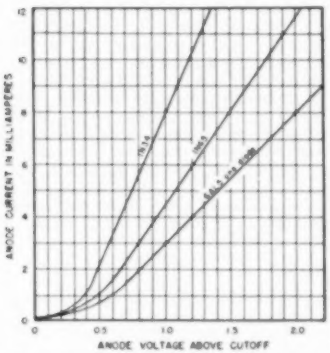


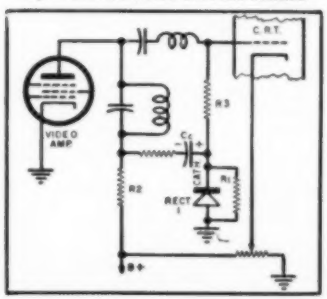
Fig. 4. Characteristics of the 1N34 and 1N65 crystal diodes and one-half of a 6AL5 tube.

parable point on the graph, including the low signal levels from .5 to .05 volts.

Fig. 5 is a circuit used in a number of modern receivers and employs a 1N65 germanium diode for d.c. restoration. Note that the germanium diode is not placed across the entire output of the video amplifier, but only across the portion obtained from R_b. Any variations of the video signal extending below the a.c. axis would result in a current flow through the d.c. reinsertion diode, charging condenser C_c to the peak level of the applied voltage. During the positive portions of the signal the charge accumulated on C_c may discharge through R_c to ground, but it is likely to hold its charge or most of it.

The time constant of the C_c, R_c com-

Fig. 5. The G-E Model 10T1 d.c. restorer.



direct

FACTORY TO YOU PRICES

Ken-Way

BOOSTER

$14.95



MODEL 6J1

- Balanced Input (72-300 Ohms)
- Balanced Output (72-300 Ohms)
- Balanced Amplifier
  1. Push Pull Neutralized 6J6 Triode
  2. High Signal to Noise Ratio
  3. Reduced Internal Circuit Noise
- Metal Cabinet-Rubber feet
- Variable tuning, combination on-off Band switch
- Signal bypasses Booster in off position



MODEL LK(7-13*)

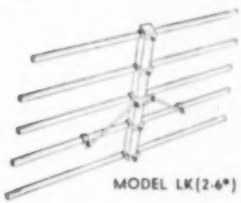
Ken-Way

FIVE ELEMENT HIGH CHANNEL CLOSE SPACED YAGI $2.95

- Cut the channel
- Sturdy aluminum construction
- Folded dipole
- Easy to stack
- 9 DB Gain

Ken-Way

FIVE ELEMENT LOW CHANNEL CLOSE SPACED YAGI $5.95



MODEL LK(2-6*)

- Low channel
- Close space
- Five element Yagi
- Cut the channel
- Easy to assemble
- Sturdy aluminum element.
- Seasoned aluminized Hardwood Boom
- 9 DB Gain
- Sensational "Delta" match to dipole
- Easy to stack

*Antennas are cut to channel—please specify channel desired on order.

We ship cash with order or 25% deposit for C.O.D. shipments.

STANDARD RTMA WARRANTY PLUS SAMPLE ORDER PROTECTION SATISFACTORY GUARANTEE OR YOUR MONEY BACK.

Ken-Way

PRODUCTS INCORPORATED

BOX 220, OWENSBORO, KENTUCKY

NEW a "must" book for every TV Service Technician

"Servicing TV in the Customer's Home"



SAVES TIME
SAVES WORK
Earns More for You on Outside Service Calls

shows how to diagnose trouble using capacitor probe and VTVM

Here's the book you've been asking for—practical, proved help to make your outside TV servicing really effective and profitable. Saves time, work and chassis hauling . . . shows you how to make successful repairs on the spot. You learn the following: **1.** A simple, effective method for tracing down trouble, using your VTVM and a simple capacitor probe. **2.** Methods for finding your way around a strange circuit—shows you how to "pull tubes" and diagnose trouble by observing audio and picture effects. **3.** How to judge TV set performance by analysis of the test pattern. **4.** Methods for making adjustments in the field. You'll want this essential, profit-building book. Handy pocket size; sturdy cover.

$1.50

ORDER TC-1. *Only* .....

Pays for itself on the very first job.

HOWARD W. SAMS & CO., INC.

Order from your Parts Jobber, or write direct to HOWARD W. SAMS & CO., 2201 E. 46th St., Indianapolis 5, Ind.

ORDER TODAY

Send . . . copy(ies) of "SERVICING TV IN THE CUSTOMER'S HOME," $1.50 per copy.

(Check) (money order) for $.....enclosed

Name.....

Address.....

City.....State.....

bination is long enough for the voltage on C_1 to remain practically constant throughout each horizontal line. This biases the picture tube in series with the picture signal as it varies with the height of the pulse peaks. Thus all the pulse peaks are lined up at the picture tube grid. R_1 is used to isolate the diode from the cathode of the picture tube so that the diode capacity will not reduce the high frequency response of the video output.

Defective restorer action is not usually apparent unless there is considerable change in background during a program. The usual sign of trouble is that the brightness control must be readjusted continually. Try a new diode first, then check the resistors and condensers.

A factor in favor of diode use is the interpretation of maximum crystal ratings in connection with their application as d.c. restorers. Since the published ratings are in terms of d.c. conditions, which imply a duty factor of unity, these ratings may be exceeded by a large percentage in pulse operation with no detrimental effects. This holds particularly true with respect to the maximum peak inverse voltage rating.

Some engineers disagree with this concept but since reverse current during a break-down of the crystal is limited by the circuit, it probably will not hurt the crystal too much to exceed the peak inverse voltage rating.

The peak signal available at the grid of the picture tube is usually about 40 volts, of which 10 volts is in sync and the other 30 represents video signal. Under the worst possible condition with an all white field prevailing the restored d.c. is approximately 24 volts; this, plus the sync pulse of 10 volts, subjects the diode to a maximum peak inverse voltage of 34 volts. Germanium diodes will easily withstand this type of service use provided certain precautions are taken regarding temperature.

The temperature rise in the hottest portions of the television receiver seldom exceeds 40 degrees Centigrade, or 104 degrees Fahrenheit. Above 55 degrees Centigrade, or 131 degrees Fahrenheit, the change in d.c. output becomes an appreciable percentage of the initial voltage. Therefore, it is advisable to locate a reinsertion diode (or any crystal, for that matter) at some point on the chassis where the temperature rise will be at a minimum. Below 40 degrees Centigrade, the changes in germanium diode characteristics are not a problem.

—30—

OSCILLOSCOPE PATTERNS QUIZ

By ED BUKSTEIN

Northwestern Vocational Institute, St. Paul, Minn.

(For Answers to the Quiz, See Page 137)

THE cathode-ray oscilloscope is to the radio-electronic technician what the stethoscope is to the doctor. Both of these instruments reveal, to the trained observer, vital information concerning the condition of the circuit or organ in question.

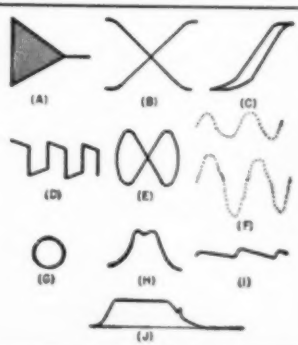
The technician works with invisible forces. He cannot see the high frequency currents surging back and forth in the tank circuits, he cannot see a charge of electrons accumulating on a condenser plate, he cannot see the counter e.m.f. generated in an inductance—he cannot see these things unless he uses an oscilloscope. To work without this instrument is to work blindfolded and handicapped.

The technician who has mastered the use of the oscilloscope, who has learned to interpret its patterns, who knows its capabilities and limitations, is a competent technician. He can "diagnose" an ailing circuit with the rapidity and sureness of an experienced physician diagnosing an organic disorder.

You can check your knowledge of the applications of the oscilloscope by pairing the words and definitions listed below with the patterns they suggest. Record your answers in the boxes provided and then check your score against the correct answers given on page 137. Your numerical score can be translated into its verbal equivalent as follows: 10 correct is excellent; 9 correct is very good; 8 correct is good; 7 correct is fair; and 6 or less correct is poor.

—30—

- ☐ 1. Hysteresis measurement
- ☐ 2. Power supply ripple
- ☐ 3. Overmodulation
- ☐ 4. Phase measurement, 90° angle
- ☐ 5. Frequency comparison, 2:1 ratio
- ☐ 6. Overcoupling
- ☐ 7. TV alignment
- ☐ 8. Electronic switch
- ☐ 9. Audio amplifier testing
- ☐ 10. Discriminator alignment



LEARN Practical RADIO AT HOME



COMPLETE ONLY . . . $19.95

BUILD 15 RADIOS

ABSOLUTELY NO PREVIOUS TRAINING NEEDED
EXCELLENT BACKGROUND FOR TELEVISION

FREE RADIO TESTER & SOLDERING IRON

10-DAY MONEY-BACK GUARANTEE

WHAT THE 1952 PROGRESSIVE RADIO "EDU-KIT" OFFERS YOU:

This is a practical home radio course. You learn theory, construction, operation, trouble shooting, code. You build RECEIVERS, TRANSMITTERS, AMPLIFIERS, CODE OSCILLATOR, SIGNAL TRACER.

You start with a simple radio circuit, and gradually advance to more complex circuits. No previous background is required. No instructor is needed. All parts and instructions are included and every single step is clearly explained.

All parts are guaranteed, individually packaged, identified, and explained.

There is nothing extra to buy. You receive all parts, tools and instructions at once. You keep everything; there is absolutely nothing you return to us.

You can easily pay for the kit in a short time by repairing radios. Use the tester and signal tracer for servicing. The signal tracer alone is worth more than the price of the entire kit.

USED BY RADIO SCHOOLS AND GOVERNMENT AGENCIES!

The Progressive Radio "Edu-Kit" includes tubes, paper condensers, mica condensers, electrolytic condensers, variable condensers, selenium rectifiers, chassis, hardware, tie strips, tube sockets, solder, wire, soldering iron, tubing, coils, instruction book, radio trouble-shooting guide, radio tester, television trouble-shooting manual, etc., in brief, everything you need in a practical radio course.

Order your "Edu-Kit" today, or send for further information.
Postage prepaid on Cash orders—C.O.D. orders accepted in U.S.A.

PROGRESSIVE ELECTRONICS CO.
497 UNION AVE. -:- DEPT. RN-3 -:- BROOKLYN, NEW YORK

GET A WELL-PAYING JOB



GO INTO A PROFITABLE BUSINESS AND PLAN FOR A FUTURE





For a Heavenly Soldering Job, Insist on

Ungar's little Angels

Need we say more?

Write for Catalog No. 410

Ungar ELECTRIC TOOLS, INC., Los Angeles 54, Calif.

WOW!

JUST A FEW OF AMERICA'S GREATEST BUYS

NAME BRAND TUBES

Joseph's makes the most amazing tube offer in history! First-time, guaranteed tubes for as low as 40c each! All are name brand such as Sylvania, G.E., RCA, etc. Some bear set manufacturer's names, all tubes beautifully cartoned. For the best at lowest prices order from Joseph's now!

1B3GT	$ .91	6SN7GT	$ .88	12SA7GT	$ .73
1X2A	.91	6T8	1.13	12SK7GT	.73
5U4G	.61	6V6GT	.70	12SQ7GT	.61
5Y3GT	.46	6W4GT	.65	25L6GT	.74
6AL5	.58	6X5GT	.52	35W4	.46
6AU6	.64	12AT6	.55	35Z5GT	.54
6AV6	.55	12AT7	1.04	50B5	.74
6BG6G	1.92	12AU7	.80	50C5	.74
6BQ6GT	1.28	12BA6	.65	50L6GT	.74
6C4	.54	12BE6	.70		

TUBULAR ELECTROLYTICS

CORONET "BLU-KAPS". Every "Blu-Kap" guaranteed for one year! Small size for efficient, easy replacements. Try some now, you'll use them regularly!

8 mfd. 450V	10 for $2.40	20 mfd. 150V	10 for $2.30
16 mfd. 450V	10 for $3.20	20-20 mfd. 150V	10 for $3.40
30 mfd. 450V	10 for $4.10	50-30 mfd. 150V	10 for $3.90
8-8 mfd. 450V	10 for $4.50		

ORDER NOW AND SAVE!

TERMS: Min. Order $5.00. F.O.B. Chicago, Ill. 25% deposit on C.O.D.'s. Prices subject to change without notice. Merchandise subject to prior sale.

FROM **JOSEPH'S** great new **FREE** SERVICEMAN'S BUYERS GUIDE



IRVING JOSEPH RADIO PARTS INC.
215 S. HALSTED ST., CHICAGO 6, ILL.

Yes, send me the new Serviceman's Buyers Guide.

NAME _____

FIRM NAME _____

CITY _____ ZONE _____ STATE _____

free →

IRVING **JOSEPH** RADIO PARTS, INC.
215 S. HALSTED ST., CHICAGO 6, ILL.

POWER SUPPLY KITS

METER BARGAINS

COMPONENT BARGAINS

CHOKES

115V FILAMENT TRANSFORMERS 60 CY

115V POWER TRANSFORMERS 60 CY

OIL CAPACITORS

POLY-TECH
919 Dawson St., New York 59, N. Y.
Tel. MUrray Hill 6-2650

Electrostatic Focus
(Continued from page 63)

accelerating grid, G_3, is recommended for the focusing anode. To obtain this higher voltage it may be necessary to connect the focus control to the horizontal boost voltage. Actual practice has shown that the first value, the approximate center of the voltages shown in Table 1, gives the best focus and the entire range indicated here is hardly needed. The table also shows that there are two types of low voltage focus tubes available and their major difference is the focusing voltages required. The 17RP4 and 20LP4, for example, would best be used in a receiver where the cathode of the picture tube is close to ground potential and the "B plus" supply has a negative bus which is below ground potential. However, the intelligent technician will be able to determine the best tube type for each replacement job by checking the d.c. voltages on the picture tube elements and referring to Table 1 for the closest approximation to the receiver voltages.

To make the actual installation an additional wire must be brought to the picture tube socket and a new prong must be fitted to make contact with pin #6. If a half round type socket is used it is usually better to install an entirely new, circular type socket than to hook up some makeshift arrangement.

In general, the problems of servicing electrostatically focused picture tubes will be less than for the magnetic types. Such common defects as a burnt focusing control or a shorted focus coil will not be found in the new type tubes. But some new and peculiar features deserve special attention.

The ion trap used in all electrostatic focus tubes is of the single magnet type. Its adjustment on the neck of the tube is much more critical than on magnetic focus tubes because the ion trap location can influence the focus to a large extent. The ioa trap should be adjusted only for maximum brightness and when all other tube elements are functioning properly, good focus will be obtainable by adjusting the focus control only. In an electrostatically focused tube it is possible to obtain brightness with incorrect voltages on G_3 and the focusing anode, if the ion trap is also misadjusted slightly. The resulting picture may have some focus in the very center of the screen, but the edges certainly will appear fuzzy. If improper focus is observed at any time with an electrostatic focus picture tube, measure not only the focusing voltage but the voltage on G_3 and the second anode as well and remember that they should be measured with respect to the cathode of the tube.

In magnetic focus tubes the centering of the picture is often accomplished by tilting the focus coil or otherwise varying the symmetry of the magnetic field. For electrostatic focus tubes a small PM centering device is usually employed to provide the centering action. Various types of PM rings, small PM tabs on cardboard discs, and similar devices are used by different manufacturers. The correct location for this centering device is as close to the deflection yoke and as far from the ion trap as possible. More centering action will be obtained if the magnets are closer to the ion trap, but at the same time some interaction takes place between the two magnetic fields resulting in less brightness, corners cut off, or even poor focus.

All of the new electrostatic focus tubes use a wide deflection angle, 66 degrees horizontally and 70 degrees diagonally, and this requires a short, wide angle deflection yoke. In most 1952 receivers these deflection yokes feature a special winding system which provides even focus over the entire screen area. Sometimes these "Anastigmatic," "Cosine," or "True-focus" yokes cause pincushioning at the top and bottom of the screen. To overcome this effect several manufacturers use small correcting magnets on the top and bottom of the deflection yoke. These anti-pincushioning magnets are currently found in some *Philco*, *RCA*, and similar models.

Aside from defective focus, the electrostatic focus tubes are subject to all of the usual picture tube defects such as becoming gassy, losing their vacuum, or going "soft." Internal arcing can occur on even the latest models if the second anode voltage is excessive or is not properly filtered d.c. For example, if the HV filter condenser were open the anode voltage would contain large positive pulses exceeding the 16 kv. limitation. Arc-over could then occur from the second anode to the focusing element. On checking the HV with a d.c. meter, only the average value would be read, giving no indication of the trouble. The only method of approaching this sort of defect is to replace the HV condenser and again measure the d.c. voltage across it. With a good filter condenser the arcing should then stop, unless the defect is due to the picture tube itself. In the HV type of electrostatic focus tube internal arcing is less likely but additional HV troubles can be encountered in the focus control circuit. Defects in any of the components in the control circuits, failure of the HV rectifier, etc., can result in loss of focus or, if the focus element were grounded, internal arc-over could occur. Measuring the voltage and resistance values in this section will invariably show up the defect at once.

All-in-all the new electrostatically focused picture tubes promise no additional burden on the service technician and certainly represent a reduction in the weight and complexity of TV sets. Born of the necessity for conserving scarce materials, these new picture tubes are a major advance towards better, cheaper, and simpler television receivers. —30—

Technical BOOKS

"REFERENCE DATA FOR RADIO ENGINEERS" by Federal Telephone and Radio Corporation Staff. Published by *Federal Telephone and Radio Corporation*, New York. 640 pages. Price $3.75. Third Edition.

The third edition of this popular reference work is the largest and best of the series. It is more than twice the size of the preceding edition and is three times as large as the initial publication.

The book is packed cover-to-cover with pertinent data which has been set up, in most cases, in tabular form to facilitate its use. The book is divided into twenty chapters which cover such subjects as frequency data; units, constants, and conversion factors; properties of materials; components; fundamentals of networks; selective circuits; filter networks; attenuators; bridges and impedance measurements; rectifiers and filters; iron core transformers and reactors; electron tubes; amplifiers and oscillators; modulation; Fourier waveform analysis; transmission lines; wave guides and resonators; antennas; radio wave propagation; radio noise and interference; radar fundamentals; broadcasting; wire transmission; electroacoustics; servomechanisms; miscellaneous data; Maxwell's equations; mathematical formulas; and mathematical tables.

* * *

"TELEVISION ENGINEERING" by Donald G. Fink. Published by *McGraw-Hill Book Company*, New York. 702 pages. Price $8.50. Second Edition.

Although technically designated a "second edition," this volume is an almost completely rewritten version of the author's "Principles of Television Engineering" which appeared some 12 years ago.

The author has followed the same basic pattern in preparing this material that prevailed in the first edition. He has assumed that the reader is familiar with the elementary principles of vacuum tube circuits and the processes of amplification, modulation, carrier transmission, and demodulation. Circuits and theories that are peculiar to television are covered thoroughly, beginning with the basic concepts.

The text material is divided into eleven major categories covering the television system as a whole, analysis and synthesis of images, cameras and picture tubes, scanning and synchronization methods, transmission of the video signal, video amplification, carrier transmission of picture and sound signals, color fundamentals, color TV systems, television broadcasting equipment, and television receiving equipment. An appendix carries the FCC "Standards of Good Engineering Practice" in abbreviated form as a reference.

—30—

TV DIRECT FROM THIS GREAT FACTORY TO YOU

BRINGS YOU

Finest Quality at Lowest Prices

TRANSVISION

TV KITS, WIRED CHASSIS, and SETS

CABINETS, COMPONENTS, INSTRUMENTS, and ACCESSORIES



SPECIAL!

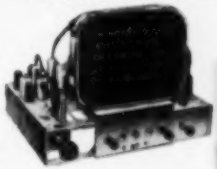
REMOTE CONTROL TV CHASSIS

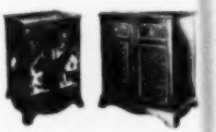
Here's the *finest buy in Remote Control TV*. Unit is *all-electronic*; no troublesome mechanical parts. Gives complete operating control of set. Plus—the *latest Transvision A-4 Wired TV Chassis*; completely aligned; ready to plug in. Has AFC and AGC. Top quality reception, even in fringe areas.

17" A-4 TV Chassis, remote control, and CRT...net $199

20" A-4 TV Chassis, remote control, and CRT...net 219

With Du Mont Tuner and FM radio, add.....10





BEAUTIFUL TV CONSOLES

Ideal for Custom-Building or Conversion. Factory prices start from $49. Send for Cabinet Catalog now.

CR TUBE TESTER-REACTIVATOR

Tests Picture Tubes and Renews Brightness of Many Dim Picture Tubes. Without removing picture tube from set, *measure Cathode emission . . . locate shorts between elements . . . locate high resistance shorts or leakage as high as 3 megohms.* Then, REACTIVATE dim picture tubes if there's no mechanical defect in tube. 110V-60 cycles; weighs 3 lbs.

$19.95 net

Fully Guaranteed.



FIELD STRENGTH METER AT NEW LOW PRICE

Improve TV installations; save half the work with the Transvision Field Strength Meter, Model FSM-1, complete with tubes..$59 net



SAVE ON PICTURE TUBES

Direct from Factory!

2 Year Factory Guarantee!

Amazing new LOW PRICES on all size Picture Tubes with Transvision's 2-Year Guarantee, prorated. Send for Price List now.



MULTI-SET CONNECTORS

feed up to 3 TV Sets from 1 Antenna

Prices: Multi-Set Conn. for 2 sets.....$4.95 list*

For 3 or 4 sets.....7.95 list*

*Dealers, write for discounts

Write for Price List on TV COMPONENTS.

Want to Make More Money in TV?

Write for the Transvision Factory Agent Plan.

FREE BOOKLET:

"INSIDE CRT, or What You Should Know about Picture Tubes." Written by CRT experts. Illustrated. It will MAKE MONEY FOR YOU. WRITE FOR IT NOW.

FREE: sample copy, Subscription. EXTRA INCOME EVERY MONTH from hints in "TV and Electronics Notes." Receive info on New Products, sales, service, conversion, etc. Monthly issues are gold mines of WRITE FOR IT TODAY! Review or send 25c to cover cost of plate and mailing for FREE

TRANSVISION, INC. NEW ROCHELLE, N. Y.

Columbia
GEM OF THE SURPLUS

HAM WINS SUIT!

Yup! Hundreds of hams all over U.S. have sorted free suits of clothes just by selling their new and used radio gear to COLUMBIA. WHY SUIT YOU? Round up everything you have in electronics. Tell us what you've got.
WARNING: We can't be held responsible if you faint with surprise when you see the startling high prices we pay!
DO IT UP RIGHT—WRITE RIGHT NOW!

LIMITED QUANTITY SALE!
Short on quantity—but long on savings!

WINE DETECTOR: WD-621. Excel. cond. $55.00
FREQUENCY METER: BC-221. Excel. shape 70.00
WALKIE-TALKIE TRANSCEIVER: BC-624. Excel. cond. 24.00
ARB RADIO COMPASS RECEIVER: 24 V. to Freq. range 100-9,000 kc. For marine or aircraft. Complete with flex cable, plugs, control box. NEW 70.00

AIRCRAFT EQUIPMENT
Now shipped just in! WRITE FOR PRICES
ARC-3 TRANSMITTER BC-44 HEADSETS
ARC-3 UHF RECEIVER ARB-7 UHF RECEIVER
ARN-7 RADIO COMPASS. Complete installation.
SCR-522 VHF TRANSMITTER & RECEIVER, complete.
APR-4 RECEIVER with TU-16, 17 & 18. Brand new

MOBILE TRANSCEIVER: BC-659. 10-meter, FM. With all tubes. 6, 12, or 24 V. power supply. Includes mike, handset, and antenna. Fair condition but sensational price $55.00
BC-669 TRANSMITTER & BC-668 RECEIVER: Cover 2 to 3 mcs. Less tubes, fair cond. EACH UNIT $3.50
Buy both & SAVE! Both for only 5.49
PE-73 DYNAMOTOR: 24 V. input, 1,000 V. output @ 270 ma. Same as BD-77. Good cond. THIS MONTH ONLY $5.95

MARINE GEAR SPECIALS!
Sailors Ahoy! A Cargo of Money-Savers!
S.W. MARINE RADIO TELEPHONE
Jefferson-Travis Emerson Radio Corp. Freq. 2-3 mcs. 2-channel, xtal control. Complete with mike, speaker, 110 V. charging unit, all tubes and instructions. 6 V. input or will run 8-10 hrs. on own battery pack. BRAND NEW, BOXED. Less xtals & batteries. ONLY $69.95
MN26-C RADIO COMPASS: Complete with tubes, loop, flex cables, plugs and control box. Excel. cond. $69.95
BC-375 100 W. TRANSMITTER. Easily converted to xtal control. With tubes, cables, dynamotor, matching unit. Excel. cond. THE WHOLE DEAL ONLY $42.50

NEW TRANSFORMERS 110 V. 60 CYCLES
Look at these sensational buys!
STANCOR P4079. 700 V. Center tap, 90 ma. 6.3 V. @ 3.5 amps & 5 V. @ 2 amps $3.25
THORDARSON TV Filter Choke T-1704. 1500 ohms, 10H inductance 1.79
THORDARSON T-13S05. 700 V. Center tap, 90 ma. 2.5 V. Center tap @ 6 amp., 6.3 V. Center tap @ 3.5 amp. 3.25
THORDARSON 15A66 CHT audio xfmr. Dynamic mike to triode-grid. Pri.: 60-0-60 to 24-15-0. To 5,7,9,2 ohms. Sec.: 80,000 ohms 2.95
HALDEX RAFTER 110 V. or 220 V. input, 580 V. center tap @ 275 ma. 6.3 V. @ 5.5 amp., 5 V. @ 3 amp. 4.95

CONDENSER SPECIALS
1 mfd. @ 400 VDC ..... Ea. 10c ..... 10 for 69c
16 mfd. @ 450 VDC. Paper electrolytic ..... Ea. 50c ..... 5 for $1.00
.05 mfd. @ 5000 VDC. Paper ..... Ea. 35c ..... 3 for 1.00

4 V. BATTERY PACK
For TBY Walkie-Talkie. New, in original boxes $4.95

PE-103 DYNAMOTOR
With filter base and cords. 6 or 12 V. input. 500 V. output. Excel. cond. Limited quantity $24.95

ARC-5 OR 274-N TRANSMITTERS
2-3.5 mcs. New $75.95
3-4 mcs. Used, excel. cond. 14.95
4-5.3 mcs. Used, good cond. 6.95
5.3-7 mcs. 9.50
7-9.1 ..... 12.50

ARC-5 OR 274-N RECEIVERS
23-5.5 mcs. Brand new $49.50
3.5-5 mcs. Brand new 24.50
6.0-9.1 mcs. Used 7.95
6.0-9.1 mcs. Brand new 12.95

28 V. RECEIVER DYNAMOTOR 1.00
14 V. RECEIVER DYNAMOTOR 9.95
RACK FOR DUAL TRANSMITTER 274-N 2.95
TRIPLE RECEIVER RACK 5.00
BC-442-A ANTENNA RELAY w/115 V. 50 cycle solenoid, condenser. Excel. cond. 3.95

All orders F.O.B. Los Angeles. 25% deposit required. All items subject to prior sale.

COLUMBIA ELECTRONIC SALES
522 South San Pedro Street
LOS ANGELES 13, CALIFORNIA

Mac's Service Shop
(*Continued from page 70*)

"Check the filament drop across that 12BA6," he ordered importantly.

Mac turned his head aside to conceal a grin as he obediently hooked the v.t.v.m. across the filament prongs of the tube. "Well I'll be—" he exclaimed. "There's only about five volts drop here."

"I thought so," Barney said complacently. "I had one just like that the other day except that a 12BE6 was the joker then."

"What do you think happens?"

"I think that a loop of the filament shorts out after the tube reaches a certain temperature. That cuts down the heat delivered to the cathode and reduces the emission."

"Why didn't the tube checker burn out the part of the filament being heated?"

"Because you checked the tube the first thing, before it got hot enough to short out. I'll bet if you yank it out of the set and pop it into the checker before it has time to cool down it will burn out now."

Mac quickly jerked the tube from the set and stuck it into the tube tester. The filament glowed brilliantly for a second or so and then went dark.

"Aw, quit trying to look as though you just invented perpetual motion," Mac said in mock disgust at the self-satisfied look on Barney's face.

"Say, Boss, not to change the subject," Barney said with more interest and enthusiasm than he had shown in weeks, "but where were you last night? I called and called because I wanted to double-check with you on some transmitter trouble on Channel 6 that was making the picture cut some funny didoes, but nobody was home."

"I was over fixing Old Man Bennett up with an earphone on his TV set. He is pretty hard of hearing, you know, and all he was getting out of his set was what he could see. Wrestling matches and prize fights were about all that made sense to him."

"Couldn't he listen with his hearing aid?"

"Not to do any good. If you ever played with one of those things, you would know that the microphones they use do the same thing any microphone does: exaggerates echoes. You've doubtless noticed that a person standing a few feet away from a broadcast microphone in any room except a studio always sounds as though he were talking in a huge hall, even though the room may be quite small. Exactly the same thing happens when you talk to a person wearing a hearing aid from a few feet away from him, and this echo is just enough to confuse a person whose hearing is not up to par. When Mr. Bennett sat right up against his TV set, he could hear pretty well; but when he backed off far enough so that the picture looked good, he could

TELEPHONE EQUIPMENT & PARTS

Brand New BM29A Remote control units, export packed, with carrying Bag ..... each $16.00
Reconditioned & tested Army EE8 Field telephones ..... each 20.00
Like New Sound Power field telephones 101-ea 22.00
New T69 handsets with dip switch for EE8 telephone ..... each 6.50
Rebuilt T80 handsets with new shell ..... each 4.75
Rebuilt like new solid handsets, A.E., W.E., Kellogg, new 3 Conductor cord ..... each 4.95
New Receiver & Transmitter elements, low impedance, interchangeable & like the W.E. HA1 & F1 elements ..... each 1.00
New W.E. Operator's Head & Chest sets ..... each 6.00
New W.E. Chest Sets with F1 transmitter—T-26 ..... each 4.00
New W.E. T-30q Throat Mikes ..... each .50
A.E. Type 41 Receiver elements for TS13 handset ..... each .75
New Cradle Grill for EE8 field telephone ..... each .25
New Capacitors CA-375 for EE8 ..... each .50
New T69 switches for handset ..... each .30
New C-105 Induction Coils ..... each .75
New C-158 holding Coils ..... each .45
Lever switches complete with C.B. & L.B. screw switch ..... each .30
C-161 Repeat Coils ..... each 2.00
C-114 Loading Coils ..... each 1.00
TM-184 terminal strips, for pole line, etc. each 2.00
W.E. 706A receivers with HA1 element—Less cord ..... each 2.00
New W.E. D-365 Relays ..... each 2.95
New W.E. 3A varistors ..... each .90
New W.E. 44A Connector Blocks ..... each .50
New W.E. Equaliters D-164752B ..... each 7.00
New W.E. A2 switchboard lamps ..... per 100 10.00
New Kellogg 40 Volt switchboard lamps ..... per 100 10.00
New Kellogg, white opal, lamp caps 279 ..... per 100 10.00
New A.E. type 41 transmitters, low impedance ..... each 1.50
W.E. Dial blanks ..... each .25
W.E. 226 protector blocks ..... per 100 10.00
New A.E. Sound power transmitters ..... each 3.00
Rebuilt Sound power handsets with new cord with alligator clips ..... each 9.50
New Kellogg 4 Conductor cords 6' for telephone handset ..... each $0.60; 3 Cond. each .50
New Rubber Switchboard cords 2 Conductor—605 ..... each .35
Upright desk telephones, tested, reconditioned, for intercoms, extension, etc. ..... each 2.95
Ringer boxes for above desk telephones ..... each 2.00
New receiver elements interchangeable with W.E. Holster Cabot Connecticut handsets, export packed ..... 350 ohms Approx. each 1.00
5-Bar generators ..... each 4.50
Battery eliminators, New for intercommunication systems, etc. ..... 115 V.A.C. input, output, 6.8 V.D.C. for talking, 8-12 V.A.C. for ringing ..... each 29.50
W.E. transmitter for up-right telephones ..... each .50
New Kellogg 82A induction coils ..... 5 for 9.00
PLQ-103 plugs, new ..... each .90
Control Boxes—BC-360 ..... each 1.00
New Allen Bradley relays 24V-50 amps D.C. ..... each 1.00
New W.E. Electrolytic condensers 250 V.D.C. D-65JC ..... 175MF-115MF ..... each .90
New Paper Capacitors 4MF ..... each .40
Cook Relays, New—turns 2200-Ohms 12 Springs—6 Make One Break ..... each 2.50
TS 13A handsets with rubber cord & PL 68 & PL55 plugs ..... each 6.50
Capacitor Kellogg 1 & 2 Mfd.'s ..... each .50
New Canvas Carrying Bags for BM 29A remote control units ..... each 1.75
CA-380 .50MFD-1MFD ..... 600V.D.C. each .90
CA-275 4MFD-50V.D.C. ..... each .75
C-161 transformers ..... each 1.00
JK34A ..... each .50
JK-37 ..... each .75
New 41" Rubber cords with PL68, each $1.00 same with PL55 ..... each 1.00
Switch SW 17 ..... each .80
Switch SW 185 ..... each .90
New BD62F switchboards ..... each 25.00
New Capacitors 1.0MFD-50W V. ..... 6 for .50
Switchboards BD 129 ..... each 60.00
Canvas & Leather bags for EE8 field telephone, ... each

Many, many more items.
Terms: Check with Order F.O.B., Brooklyn 5, N. Y.

EASTERN TELEPHONE CO.
321 Vanderbilt Ave. Brooklyn 5, N. Y.

RADIO and TELEVISION ELECTRONICS
RCA
Thorough training for men and women in all Technical phases
Enroll NOW for New Classes (Day & Eve.) which start 1st of Mar., June, Sept. & Dec.
Free Placement Service For Graduates
For Free Catalog write Dept. RN-5-2
RCA INSTITUTES, INC.
A Service of Radio Corporation of America
350 West 4th St., New York 14, N. Y.


Another Outstanding Jobber
LIFETIME ELECTRONICS
1301 ADAMS STREET • TOLEDO, OHIO
EICO has all 17 KITS & INSTRUMENTS in stock!
See EICO ad on Page 10

not understand what was being said."

"What kind of an earphone did you use?"

"A regular hearing-aid earphone that would snap into the moulded plastic earpiece he has. It so happened that he had an old hearing aid he no longer uses, and I got the earphone from that. I measured it and found that it had a d.c. resistance of about 30 ohms; so I tried it right across the voice coil of the speaker, and it worked beautifully. When the set is adjusted to just normal room volume from the speaker it is also just right for Mr. Bennett and his earphone, and the extra load represented by the earphone is so light that you cannot notice any difference when it is connected across the speaker. I ran a couple of leads from the voice coil to a jack on the back of the cabinet. From a plug in this jack a length of lampcord runs down through a small hole in the floor behind the cabinet, across the joists in the basement, and then back up through another small hole in the floor to a jack mounted on the baseboard right beside Mr. Bennett's favorite chair across from the TV receiver. A few feet of flexible cord and a plug allows him to plug his earphone into either this jack by his chair or the one on the set."

"Why both jacks?"

"Well, usually his wife tunes the TV set, but there might be times when he will have to do this for himself. Then all he has to do is pull the earphone plug from the jack beside his chair and walk over and plug into the jack on the receiver. When he has the set correctly tuned, he can replace the lampcord plug in the cabinet jack and go back and plug his earphone into the baseboard jack. On top of that, the jack on the cabinet allows the lampcord to be disconnected when it is necessary to pull the set away from the wall."

"What did he think of it?"

Mac smiled reminiscently as he replied, "Barney, when I saw that old man sitting there chuckling and slapping his leg at some of Bob Hope's fast-talking nonsense, I felt I had been repaid for all of the headaches we have in this wacky business. The few minutes spent attaching that earphone to the TV set meant hours and hours of pleasure and entertainment for that old fellow."

"Yep, Boss," Barney agreed, "this radio and television game is a pretty good one at that. There are times, of course, when a fellow feels a little low and discouraged as I did a couple of hours ago—although I'll be darned if I can see *why* now—but most of the time I feel as I do right this minute when I can hardly wait to get at the next set."

"Hold that mood!" Mac shouted as he dashed across the room, snatched a small set from the set-to-be-repaired group, and rushed back to place it on the bench in front of his broadly-grinning, red-headed assistant.

—30—



Years ahead in listening pleasure

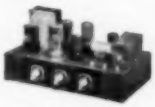
When you own a Newcomb amplifier you own more than just a carefully built piece of electronic equipment that measures up to the most exacting mechanical requirements. You also own . . . what you *really* want . . . the phonograph amplifier that's designed to give you ***the most in listening quality.***

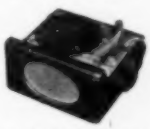
Let your own ears be the judge. When you listen to a Newcomb you hear your favorite recordings or radio and television shows come gloriously to life. These superb amplifiers are subjected to rigorous testing procedures throughout their production to insure mechanical and electrical perfection. BUT . . . *more than that* . . . they must meet the most critical *listening quality* tests.

Newcomb Model KXLP-30 is a 20-20,000 cycle, low distortion, 30 watt phonograph amplifier providing the reserve power to make full use of its special tone control circuits. Superbly balanced electrical design, the result of many years experience, gives you remarkable *listening quality*. The ***Magic Red Knob*** four stage record condition compensator frees tone controls from the function of controlling surface noise. Thus any desired tonal balance may be obtained under any condition of operation at any volume level. Adaptable for use with AM-FM radio tuners, TV, wide range loudspeakers and magnetic or crystal pickups, it is engineered for *your listening pleasure.*

Write for complete descriptive literature


Model HLP-14, 14 watt Phonograph Amplifier


Model P-10A, 10 watt Phonograph Amplifier


Model R-12, Three Speed Portable Phonograph


Model RC-12, Three Speed Portable Phonograph

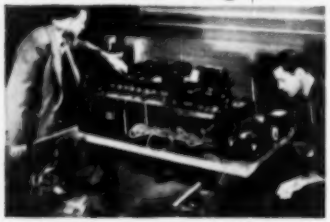

Model B-100 Radio

THE SOUND *Newcomb* THAT QUALITY BUILT

NEWCOMB AUDIO PRODUCTS CO., DEPT. F, 6824 LEXINGTON AVENUE, HOLLYWOOD 38, CALIFORNIA

MANUFACTURERS OF P.A., PHONOGRAPH, MOBILE, INSTRUMENT AND WIRED MUSIC AMPLIFIERS PORTABLE SYSTEMS, PHONOGRAPHS, RADIOS, TRANSCRIPTION PLAYERS AND RACK EQUIPMENT

Become an Electrical Engineer



MAJOR IN ELECTRONICS



- **B. S. Degree in 36 Months**
- **Radio-Television Technician Certificate in 18 Months**

By 1954 there will be *at least* two positions for every engineering and technician graduate. This College offers a tested plan that permits you to enter these vast employment opportunities at an early date. First—you save a valuable year through optional year-round study. Second—you can receive *advanced credit* for prior training gained in the armed forces, other schools or field experience.

Enter Both Radio and Television Through This Plan

12 months or one-third of the B. S. degree course (Electronics major) — also brings you the *Radio Technician's* certificate. An added 6-month course qualifies you for the *Radio-TV Technician's* Certificate.

The Proven "UNIT CHASSIS SYSTEM"



of teaching was developed here. It "breaks down" the TV set by stages. You learn every component of all types and makes — and are prepared for future design changes, including the advent of color.

SPECIAL! Television Clinics

Ambitious Radio and TV Servicemen can enroll now in special one-month spring or summer clinics—to handle latest field service problems. Combine education and vacation.

Over 48,000 former students from all states and 23 overseas countries. Faculty of trained specialists. Modern laboratories and equipment. Nonprofit technical institute and college 40th year.

MILWAUKEE
SCHOOL OF ENGINEERING
Founded 1903—Milwaukee, Wis.

Terms open April, July, October, January

FREE — Write for "Occupational Guidance Bulletin," "Your Career" booklet, and Catalog.



Milwaukee School of Engineering
Dept. RN 352, 1025 N. Milwaukee
Milwaukee, Wisconsin

Without obligation send Catalog for Electrical Engineering, B. S. Degree, major in ☐ Electronics ☐ Power ☐ "Your Career"; Occupational Guidance Bulletin on: ☐ Radio-TV; ☐ Electrical Power; ☐ Welding ☐ Heating, Refrigeration Air Conditioning ☐ TV Service Clinic.

Name ..... Age .....

Address .....

City ..... Zone ..... State .....

If veteran, indicate date of discharge .....

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

RECTIFIER REPLACEMENT

The Selenium-Intelin Division of *Federal Telephone and Radio Corporation*, 100 Kingsland Road, Clifton, New Jersey has just issued a "Selenium Rectifier Replacement Guide" designed to facilitate receiver servicing.

This 32-page book is divided into nine sections covering TV replacement part numbers, radio replacement part numbers, code numbers and miscellaneous replacements, operating characteristics of *Federal* units, fundamental circuits and servicing information on *Federal* rectifiers, servicing information, data on how to replace the 35Z5 with the company's 100 ma. selenium rectifier, "packaged power," and a cross index of part numbers.

Copies of this guide are available from the company at a charge of 50 cents each.

"REPS" DIRECTORY

The Los Angeles Chapter of "Representatives, Inc." has issued its 1952 directory, containing 40 pages and covers.

This seventh edition carries a comprehensive product index with 310 subheads and upwards of 4000 listings under various classifications. The data includes an alphabetical list of manufacturers represented, the officers and committeemen for 1952, and a list of senior members and associates.

Copies of this new directory are available from the chapter's publication office at 767 Castelar Street, Los Angeles 12, California. Requests should be addressed to the attention of the executive secretary-treasurer, Dr. Ralph L. Power.

RCA TV BOOKLETS

The Tube Department of *Radio Corporation of America*, Harrison, New Jersey has released two of its new television data books to all technicians.

The first booklet, "*RCA* Kinescopes," is a comprehensive manual containing data on more than 100 different kinescope types now in use. The publication provides such reference information as characteristics of the company's complete line of kinescopes, a replacement directory listing competitive units and the corresponding *RCA* "direct replacement" type or the company's "similar type," and a picture tube conversion chart. This book is listed at 25 cents.

The second publication is entitled "Television Servicing" and comprises a collection of special articles prepared by *RCA*'s John Meagher and Art Liebscher. In addition to new articles on TV servicing by Mr. Meagher and a new paper on TV tuner alignment by Mr. Liebscher, the book contains all of the Meagher articles on TV servicing which originally appeared in the "*RCA* Radio Service News." Subjects covered include r.f.-i.f. alignment, troubleshooting, and circuit analysis. This book sells for 35 cents.

Either or both of these new publications are available from the company's tube distributors or from the Commercial Engineering Section of the Tube Department.

DESIGN INDEX

Thordarson Meissner Manufacturing Division, Mt. Carmel, Illinois has issued a comprehensive reference work covering more than fifty-thousand field-proved transformer designs.

The new publication, which covers virtually the entire field of filters, chokes, and transformers presently required by the industry, has been issued in book form and is available to engineers.

Inquiries regarding this new "Transformer Design Index" should be addressed to the company at Mt. Carmel.

NEW ASA STANDARD

The American Standards Association, 70 East 45th Street, New York 17, N. Y. has released its new standard covering "Graphical Symbols for Single Line Electrical Engineering Diagrams."

The new standard (Z32.1.1-1951) coordinates and modifies the single line diagrams contained in the "American Standard Graphical Symbols for Electrical Power and Control (Z32.3-1946) and for "Telephone, Telegraph and Radio Use" (Z32.5-1944).

For the first time single-line diagrams for use in both power and communication work are combined and contained in one volume. They represent an agreement reached by representatives of the electric, telephone and telegraph, radio, public utilities, and the government on standard single-line symbols.

Copies of this new standard are available from the ASA at $1.40 per copy.

COAX CONNECTORS

Transradio Ltd., 138A, Cromwell Road, London, S.W.7, England has issued a bulletin describing its line of precision coaxial connectors.

The publication, which has been designated TR-7B, pictures several different types of units and provides comprehensive data on the company's

complete line in tabular form. A few types of U.S. JAN connectors are also listed on this data sheet.

Requests for copies of publication TR-7B should be sent direct to the company.

WRL 1952 CATALOGUE

World Radio Laboratories, Inc., 744 W. Broadway, Council Bluffs, Iowa is now offering copies of its new 1952 catalogue to interested persons.

Designated Catalogue No. 12, this new 140-page publication lists transmitting equipment, converters, tubes, amateur gear, test equipment, television accessories, books, service manuals, etc. It also carries a listing of reconditioned equipment available from the company.

The catalogue is indexed by both manufacturer and product to facilitate reference. Copies of this publication are available without charge.

HIGH-MU POWER TRIODE

Lewis and Kaufman, Inc., Los Gatos, California now has available a technical data sheet describing its Type 100TH high-mu power triode.

The tube is illustrated and described with dimensions, operating curves, and electrical characteristics. Typical operation and maximum ratings are given for the tube in service as a class AB audio frequency power amplifier and a class C power amplifier and oscillator.

SURVEY OF LUMINESCENCE THEORIES

The possibility of better television tubes and fluorescent lamps is suggested in a survey by Navy researchers on the theories of luminescence which is now available in booklet form from the Office of Technical Services of the U.S. Department of Commerce, Washington 25, D. C.

The report provides a fairly extensive theoretical background based on existing theories as they apply to individual systems of luminescence. These theories reveal how luminescence problems have been treated gen-

(*Continued on page* 136)

more T-V set outlets per dollar!

with easy-to-install

Blonder-Tongue

ALL-CHANNEL MASTER ANTENNA SYSTEMS



Distribution Amplifier
8 TV Set Outlets
Model #DA8-1-M List Price $87.50



Distribution Amplifier
2 TV Set Outlets
Model #DA2-1-M List Price $39.50



Commercial Antensifier (30 Times Gain) Use As Pre-Amplifier, Line Amplifier or de-luxe Booster
Model #CA-1-M List Price $77.50

More Gain Per Dollar!

8-T Home Antensifier Model HA-2-M Finest All-Channel TV Booster. Fully Automatic, 16 Times Gain. In Metal Cabinet List Price $57.50



Literature on Request write Dept. E3

Blonder-Tongue Labs., Inc. Mt. Vernon, N. Y.

High score every time with "Safe Centers!"



In Basketball there's no better assurance of victory than a lengthy lad jumping center . . . and there is nothing that scores higher in radio, TV and other electronic circuits than SELETRON miniature rectifiers with "Safe Center" plates.

When you specify SELETRON Selenium Rectifiers you eliminate arc-over danger, short circuits and heating at the center contact point. Assembly pressure, or pressure applied in mounting the rectifier cannot affect its performance — a SELETRON feature accomplished by deactivating the area of the plate under the contact washer.

The millions of SELETRON Selenium Rectifiers in satisfactory service as original equipment in the products of leading manufacturers are millions of reasons why you can specify SELETRON and be *safe!*

Look for Howard W. Sam's Red Book Supplement listing SELETRON replacements . . . and write for Bulletin No. 104-N-1

Seletron

SELETRON DIVISION
RADIO RECEPTOR COMPANY, Inc.

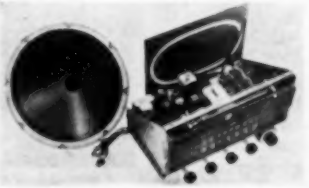
SAVE

THAT GOOD LOOKING OLD CONSOLE— REPLACE YOUR OBSOLETE RADIO

with a modern, easily installed

ESPEY AM/FM CHASSIS

and your favorite console is *"right-up-to-date"*



Rated an excellent instrument by America's foremost electronic engineers. Fully licensed under RCA and Hazeltine patents. The photo shows the Espey Model 511-C, supplied ready to play. Equipped with tubes, antenna, speaker, and all necessary hardware for mounting.

NEW FEATURES—Improved Frequency modulation circuit, drift compensated • 12 tubes plus rectifier, and pre-amplifier pick-up tubes • 4 dual purpose tubes • High quality AM-FM reception • Push-pull beam power audio output 10 watts • Switch for easy changing to crystal or variable reluctance pick-ups • Multi-tap audio output transformer supplying 4—8—500 ohms.

Write Dept. RN-3 for literature and complete specifications on Model 511-C and others.

Makers of fine radios since 1928.

ESPEY MANUFACTURING COMPANY, INC.

NOW!

The Sensational New

WEATHERS One-Gram Capacitance Pick-Up

(Cartridge Form)



AT LONG LAST! — REALISM without noise

20 TO 20,000 CYCLES

Adjudged Sensation at November New York Audio Show.

Will Improve and Replace Any Modern Phonograph Pickup

- ✓ One gram stylus pressure with ideal tone arm
- ✓ Two grams pressure on modern Webster changers
- ✓ Very low pressures with other players, including RCA 45 changer
- ✓ Will operate properly with most good quality tone arms

Constant Amplitude Response, 20 to 20,000 cps. 1 volt into ½ megohm at 1000 cps.

AES Response Equalization from separate output connection, for LP records.

Replaceable 1-mil sapphire stylus (choice of 1-mil or 3-mil sapphire stylus on request). Records last thousands of plays. One sapphire plays thousands of records.

WEATHERS CARTRIDGE AT A NEW LOW PRICE

Complete with ultra-flexible cable, oscillator unit, tube, installation hardware and instructions ..... net **$37.50**

WEATHERS power supply, complete with power cord, for 117 volts, 60 cps. ..... net **$14.50**

Oscillator requires 6.3 volts ac at 0.3 amp, and 250 volts dc at 2ma. Available from most amplifiers.

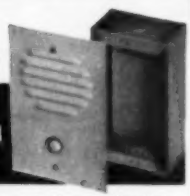
Check or Money Order. No C.O.D.'s Please. Shipments postpaid in U.S.

WEATHERS INDUSTRIES

510 RICHEY AVE., W. COLLINGSWOOD 8, N. J.

Attractive Low Cost Easily Installed

LOWELL INTERCOM LOUVRES



For Multiple Apartment, Homes, Hospitals

Here's a low-cost intercom louvre, complete with pushbutton, that will satisfy the most exacting customer, yet keep your installation time and costs down to a minimum!

The Lowell Model C3 is a flush-mounting louvre stamped from 16-gauge steel equipped with push-button, and finished in white. Dimensions: 7" x 4½".

The Lowell Model CB3X is a heavy steel box with ¾" knockouts, used with the C3 louvre for protection of the speaker. All hardware furnished, for mounting plate to box. Dimensions: 4" wide x 6" high x 2" deep. Finished in Zinc Chromate.

LOWELL MANUFACTURING CO.

Mfrs. of Lowell Speaker Baffles — Heard Everywhere

3030 Lacledo Station Road, Maplewood 17, Missouri

Canadian Representative:

ATLAS RADIO CORPORATION LIMITED

560 King Street W., Toronto, Ontario

LEARN CODE NOW!!!

BE A RADIOMAN . . . Code ability recognized by all Service Branches. Here is an Electronic Code Trainer complete with Army Key-Tube Phone-Variable Note. Simple plug in A.C. or D.C. and use. Instructions and simplified code training course included. Factory Guaranteed . . . Complete as advertised. Nothing else to buy. We pay postage. Send Check or Money Order.



$5.95

For Group Training, Deluxe model with 5" Speaker, $7.75.

Additional Keys, for either unit, each $1.00.

GREENWICH SALES CO. 57 CORTLANDT ST. NEW YORK 7, N. Y.

IF YOU BUY ON SPECIFICATIONS



and tops in value, you'll buy the

TWIN-TRAX® TAPE RECORDER

"Choice of Engineers Everywhere"

Compare the guaranteed specifications of a Twin-Trax Tape Recorder with any other recorder in any price class. You'll find that Twin-Trax gives you more features, better all-around performance and more value for your money.

Complete specifications, performance ratings and direct factory prices in our catalog 5109. Send for it today.

*Trademark Reg.

AMPLIFIER CORP. of AMERICA

398 Broadway New York 13, N. Y.

erally and may be used as a guide in understanding the processes involved.

Major subjects covered include activators, electron traps, efficiency of luminescent materials, etc.

Orders for report PB 102 597 must be accompanied by check or money order for $1.00, made payable to the Treasurer of the United States.

SHOCK TESTING

Haines Designed Products Corporation, 117 North Findlay Street, Dayton 3, Ohio has available copies of its 4-page technical bulletin, "Instrument Shock Testing Theory and Measurement" which it will distribute to interested persons.

The booklet describes in detail the use of the company's shock testing mechanism (conforming to JAN-S-44 specification). Calculations, operation, and instrumentation are fully covered.

REPLACEMENT CONDENSERS

Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey has just released its 28-page catalogue covering service replacement condensers.

Known as Catalogue 200C, the new publication lists several new *C-D* condenser types, extends the regular listings to include additional popular sizes and values, and carries data on the company's complete line of electrolytic photoflash units and commercial mica transmitting and replacement transmitting condensers.

Indexing and listings have been simplified, making for quicker and easier identification of the products.

Copies of this catalogue are available from *C-D* jobbers or from the Jobber Division of the company at South Plainfield. Specify Catalogue 200C.

CABINET DATA

G. & H. Wood Products Company, 75 North 11th Street, Brooklyn 11, New York now has available for distribution a folder covering its "Cabinart" line of cabinets for radio and television.

Twelve individual sheets are included in the folder which provide complete data on a wide variety of cabinet units. Speaker housings, radio-phonograph cabinets, television cabinets, and combination units are included.

Copies of this folder and data sheets on the company's corner folded horn enclosures (both assembled and in kit form) are available from the company.

ASTRON CATALOGUE

Astron Corporation, 255 Grant Avenue, East Newark, New Jersey has issued a new catalogue which gives performance data and test characteristics on its line of condensers and r.f. interference filters.

Designated Catalogue AC-3, the new publication lists and illustrates a comprehensive line of dry electrolytics, along with all applicable engineering data. The "Metalite" section covers, in addition to pertinent data, the history of the use of metallized paper in

condensers, advantages, and engineering performance data, curves, and test procedures.

A request on organization letterhead will bring a copy of Catalogue AC-3.

RADIO-RECORDER SLIDES

Grant Pulley & Hardware Company, 31-85 Whitestone Parkway, Flushing, N. Y. is currently offering a new, four-page circular describing the uses, application, and installation of the company's "radio-recorder slides."

These slides enable the radio, recorder, or phonograph unit of a console to slide in or out of its cabinet. The booklet describes the two different models that are currently available —one for underneath mounting and one for side mounting.

JOHNSON CATALOGUE

E. F. Johnson Company, Waseca, Minnesota has announced the availability of its new "General Products Catalogue #972."

Products listed for the first time include the company's "Viking I" transmitter, the "Viking" v.f.o., the Faraday shield for the company's plug-in links, #229-201 rotary inductor, #126-105 crystal socket, and the company's new knob and dial line.

NEEDLE GUIDE

M. A. Miller Manufacturing Company, 1169 East 43rd Street, Chicago 15, Illinois has issued a revised needle replacement cross reference guide which has been brought up-to-date as of December 1951.

The guide clearly presents the catalogue numbers of all cartridges and correlated needles. Included are the company's catalogue numbers and also catalogue numbers of other leading needle manufacturers.

The material is presented in tabular form to facilitate the use of the catalogue by dealers, service technicians, and jobbers.

MOTOR GENERATORS

A copy of Bulletin 440 describing the company's complete line of 400 cycle motor generator sets is now available without charge from *Bogue Electric Manufacturing Company*, 52 Iowa Avenue, Paterson 3, N. J.

These motor generator sets, which have been designed for use in laboratories, factories, in industrial operations for testing electronic equipment, and operating high frequency motors and radar equipment, are comprehensively discussed in this new publication.

Requests for copies should be addressed to L. G. Sands, general sales manager of the company. —30—

ANSWERS TO QUIZ

(See page 128)

1	C	4	G	8	F
2	I	5	E	9	D
3	A	6	H	10	B
		7	J		

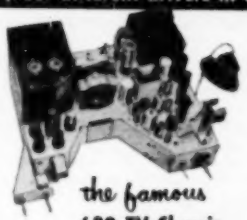
FREE GIFT

4 in 1 SCREW DRIVER

(Four different drivers in one holder)



YOURS WITH PURCHASE OF $15 OR MORE



the famous 630 TV Chassis World's Finest

T V RECEIVER

The New and Improved Super Famous "630" T.V. Chassis, is a 30 tube high quality television receiver (including 3 rectifiers) manufactured under license by the Radio Corporation of America. This chassis is the standard by which all other T.V. chassis are measured. Standard R.M.A. Guarantee! FREE replacement on all defective tubes and parts.

FEATURES: • Full channel coverage. • Discriminator-type FM sound system. • Improved picture brilliance. • AFC horizontal hold • Keyed AGC. • Stabilized vertical hold. • 3 stage sync. separator and clipper. • Automatic brightness control. • 2 Mc band width. • Highest quality parts used. All standard tubes. • For all Cathode Ray tube sizes and types. 16", 17", 19", 20", 21" Tubes. Perfect for Fringe Area Reception.—Will work where most sets fail to operate.

With HiGain standard coil tuner and R.C.A. Hi-Fi 12" Speaker, complete with knobs and hardware. Complete with Fed. Taxes Paid.

Less Cathode Ray Tube **$141.50**

630 DX Chassis—Extra power for fringe areas. Can be operated without booster or complicated antenna. Complete with Fed. Taxes Paid. Less Cathode Ray Tube **$151.50**

Available with DuMont Input Tuner FM Radio, less Cathode Ray Tube **$148.50**

Chassis Mounting Brackets when ordered with chassis $4.95

BRAND NEW STANDARD BRAND TUBES—

Individually Boxed and Guaranteed

6Z4	.50	6BN6	1.32	717	1.19
1A3	.89	6BQ6	1.44	7K7	1.19
1A6	.89	6C4	.76	7L7	1.19
1A7	.98	6C5	.79	7N7	.99
1B1	1.02	6C6	.85	7Q7	.89
1B5/25S	1.09	6CB6	.86	7T7	1.19
1H5	.89	6CD6	2.49	7Y4	.86
1I6	.74	6D6	1.09	12A4	.84
1L4	.74	6D8	1.39	12A6	.79
1LA4	1.12	6F5	.88	12A8	.88
1LA6	1.12	6F8	1.49	12AL5	.86
1LC5	1.12	6H6	.76	12AT6	.85
1LC6	1.12	6J5	.59	12AT7	1.09
1LD5	1.12	6J6	1.09	12AU6	.89
1LN5	1.12	6J7	.81	12AU7	.96
1N5	.87	6K6	.86	12AV6	.79
1R5	.82	6K7	.74	12AV7	1.24
1S5	.79	6L5	1.39	12AX7	.99
1T4	.81	6L6GA	1.69	12BA6	.79
1U4	.79	6L7	1.19	12BE6	.79
1U5	.78	6M7	1.09	12BH6	.89
1V2	.99	6Q7	.88	12J5	.79
1X2A	.96	6S4	.76	12Q7	.79
2A6G	.84	6SA7	.76	12SA7	.78
2A5	.84	6SF7	.99	12SJ7	.78
3A4	.89	6SG7	.99	12SK7	.77
3Q4	.89	6SN7	.89	12SL7	1.09
3Q5	1.02	6SJ7	.76	12SN7	1.09
3S4	.88	6SK7	.79	12SQ7	.68
3V4	.99	6SL7	1.19	14A7	1.01
5U4	.65	6SN7	.89	14B6	1.03
5V4	1.10	6SR7	.86	14B8	1.03
5W4	.83	6SQ7	.72	14N7	1.07
5Y3	.67	6T8	1.19	14R7	.82
5Y4	.75	6V6	1.09	14W7	1.09
5Z3	.89	6V6GT	.86	15T8	1.34
5Z4	1.12	6W4	.86	25A6	1.09
6A3	1.59	6W6	.89	25B05	1.49
6AB7	1.39	6X4	.74	25L6	.85
6AC7	1.39	6X5	.74	25W4	.88
6AF6	1.10	6Y6	.96	25Z6	.74
6AG5	.86	7A4	.89	32L7	1.49
6AG7	1.59	7A5	.99	35L6	.86
6AM6	1.49	7A6	.86	35W4	.80
6AK5	1.49	7A7	.86	35Y4	.86
6AL5	.68	7AD7	1.92	3525	.57
6AQ5	.72	7AF7	.89	47	1.34
6AR5	.67	7AG7	1.05	50A5	.96
6AS5	.99	7B5	1.05	50B5	.86
6AT6	5.39	7B6	.89	50C5	.86
6AT6	.80	7B8	.99	50L6	.72
6AU5	1.59	7C4	.79	50Y6	.99
6AU6	.76	7C5	.89	56	.66
6AV6	.67	7C6	.99	70L7	1.69
6BA6	.69	7E5	.90	77	.89
6BA7	1.16	7E6	.99	80	.79
6BC5	.88	7E7	.99	117Z3	.78
6BE6	.82	7F7	.99	2051	1.22
6BG6	1.76	7H7	.96	117N7	1.79
6BH6	.86	7G7	1.21		

TV CONSOLE CABINETS



Designed and built by master cabinet makers. Genuine Mahogany wood with hand rubbed piano finish. All panels ½". Supplied complete with tube mounts, speaker grille and back. (Masks extra, see below for prices) Dimensions—23" wide x 39½" high x 23" deep.

No. 1 Cabinet—For 630 chassis with all holes drilled on front panel for controls and 17" or 20" tube opening. (Specify size wanted.)

No. 2 Cabinet—Blank front panel to accommodate any make TV chassis. Tube openings for 17" or 20". (Specify size wanted.) Special Price **$47.95**

17" LUCITE MASK $5.95
20" LUCITE MASK 6.95

TERMS: 20% cash with order, balance C.O.D. Prices F.O.B. N. Y. City warehouse. Min. order $3 (allow for postage). Prices in this ad supersede all others published.

TV PICTURE TUBES

ONE YEAR UNCONDITIONAL GUARANTEE. All black faced-non glare—SHELDON, THOMAS, and other famous makes.

10BP4A	$22.95	17BP4	$25.90
12LP4A	22.95	17HP4	27.90
14BP4	23.95	19AP4	35.90
16HP4	31.95	19EP4	35.90
16KP4	28.95	19DP4	55.00
16GP4	31.95	20CP4	35.95
16LP4	31.95	24AP4	69.90

free

CATALOG

UP-TO-THE-MINUTE selection of merchandise including TV antennas, cabinets, parts, hardware and accessories.

STEVE-EL ELECTRONICS CORP. VISIT OUR NEW STORE

Dept. N-3 61 Reade St., New York 7, N. Y. COrtlandt 7-0086

CATALOGUE SPECIALS

NOVICE CW TRANSMITTER

Here's a neat and compact portable item which operates very simply in 3700-3750 KC crystal controlled. Conditions? Guaranteed solume. Instructions? Yes, no foreign parts. Complete, uncomplicated, step-by-step; nothing left to guesswork. This is the 4-tube one-band transmitter which has been such a favorite with old-timers. By the time the parts specified in DC-457, described in November QST, will be all gone, we've worked out new components for DC-458. But don't wait until these are all gone! ONLY $7.95

APN-1 WOBBULATOR
(Rec. Radio & TV News)

Now you can build that "VERSATILE SWEEP FREQUENCY GENERATOR". We've managed to acquire only 100 of the APN-1 as a result of a unique deal. HURRY! With reprint of the article $6.95

BROADCAST BAND & AERO

MN-26-C Remote Controlled navigational direction finder and communications receiver. Manual DF in any one of three freq. bands, 150 to 1500 KC. 24 V. Self contained dynamotor supply. Complete installation, including receiver, control box, loop, azimuth control, Left-Right indicator, plugs, loop transmission line, and flex. shafts. BRAND NEW, ORIG. PACK $69.50
MN-26-C alone, New $39.50

MH-20-E BENDIX LOOP

Here is a dandy! Use as a remote-controlled loop with MC-124 flexible shaft, or mount a lightweight loop on the loop and use the step-ring to feed it. Inside gears are 15:1 ratio. Originally used with MN-26 or BA-10-DB. BRAND NEW and CLEAN. Special, ONLY $6.95
MC-124 flexshaft, will ship length closest to specify 30¢ ft.
MN-32 crank drive with azimuth scale, for panel mtg., 15:1 ratio $2.50

MARINE RADIOMEN

Sold now for our latest Marine Catalogue describing and giving the famous "G.L. MARINER" transmitters, receivers, and Direction Finders.

4 USES—4 DOLLARS

The most versatile dynamotor in surplus! The best dynamotor for conversion to 6 v. Multiple windings! After conversion get choice of 1100 v. at 150 MA or 250 v. at 100 MA. No brushes to shift around, no mechanical work to use it as a 2:1 or 4:1 step-up or step-down transformer for DC voltage. Changes 6 to 12, or 12 to 24, or vice versa, up to 3 A. Or use it as a GENERATOR. Form with motor, get 12 v. DC at 3 A or 24 v. DC at 6.5 A plus high voltage. Includes easily removable self-contained filtered input and output. Complete drop sheet furnished. BRAND NEW $4.00

PRECISION CALIBRATED TUNER

Build a 6-meter or an audio oscillator, a signal generator, a VFO, an entire radio receiver, or anything. If! Lab-standard accuracy and resistability. 3 gang condenser assembly with 4" precision dial etched in 3 1/2 meter bands plus a reference scale. Has vernier planetary hairline indicator, 30:1 ratio drive assembly, all gears spline-loaded double-ended, for tuning lock. Plates are two single speed 250 mmf, and one double-spaced 260 mmf section, plus single speed section to eliminate drift. All are ceramic insulated. Neat and compact. Uncle paid a lot of money for this unit! Now yours, complete with knobs, escutcheon. Was the VFO tuner for Collins TCS unit. We furnish free schematic complete TCS-12 with this. ONLY $4.95

NEW CARBON MIKE

A little gem! Same impedance as T-17, but hold in the palm of your hand. Nice flexible cord with standard 3 conductor plug. Press-to-talk switch. New equipment. BRAND NEW $2.79

COMMAND EQUIPMENT
With free drop sheets and schematics

RECEIVERS

BC-455, 6.0 mc. NEW $12.95, GOOD USED $7.95

TRANSMITTERS

T-19 ARC-5, 3-4 mc. Excellent $17.95
BC-457 or T-20 ARC-5, 4-5.3 mc. Like new $12.95
BC-458 or T-21 ARC-5, 5.3-7 mc. Excellent used $7.95
T-23 ARC-5, VHF, 100 mc. Excellent used $24.95
Mod. kit, used, less tubes $9.95
Mod BC-459, brand new $5.95, Excellent used $2.49
T-17 is for parts 1.29
274N PLUG. 7 prong male plug to fit back of command revrs, xmtr units. Fits in the same plug as used in the racks. NEW, each 21¢, box for $1.00
Control Adapter Parts Set for 274N or ARC-5 revr. Exact set, switch, knobs, etched plate, and instructions. Ready to mount $1.29
SPLINE TUNING KNOB 79¢

9 TO 13 VOLT TRANSFORMER OR LINE VOLTAGE BOOSTER

Tapped transformer. Input 115 v 60 cy., 9 to 13 volts out in 1-volt steps at 3 amps. Our free schematic shows lots of uses. NEW $1.89

HI-FI DYNAMIC HEADSET!

A lucky purchase from Uncle! This is the DYNAMIC set, using waterproof Blue Plastic cones, which gives absolutely best music reproduction. Far from almost nothing to beat for HI-FI. Permeflux set price now is $10.95 per set! These have large chamois cushion ear pads and headband pad snaps off and on with dot fasteners for cleaning. Mis-matching impedance 10:2 makes no difference with these tubes. Base notes extend full 15 cycles, tweeter don't miss them! 4.00 ohms impedance. Checked out $4.95

FREE! NEW CATALOGUE!
Interesting, Descriptive. Nothing but Bargains! Send for it Now!

AUDIO SUPER-SPECIALS

SUPER HI-Q high cut choke, 2.65 H, 55 ohms DC. Tune with .001—.0004 MF. ONLY 98c
LOW CUT, 1 H, 284 ohms. Tune with 1 MF or use as 10 cy filter choke. ONLY 98c
OUNCER Transformers, use for mike to push-pull grids. Put up to 10 mw CW, other for push-pull output, tapped sec. Use as reversed with resistor, etc. BOTH FOR ONLY $2.29
PHASE SPLITTER, or low-level mixer, or hybrid, or push-pull xmtr. Has 3 windings, each exactly 1:1 to any other; essentially flat 100-15,000 CPS.
BRAND NEW, ONLY 89c
ONE OF EACH OF ABOVE, ALL FOR $4.00

G.L. ELECTRONICS

905 S. Vermont Ave., Los Angeles 6, Calif.
All Prices F.O.B. Los Angeles Calif. Buyers Add Sales Tax

R. F. Amplifier

(*Continued from page 55*)

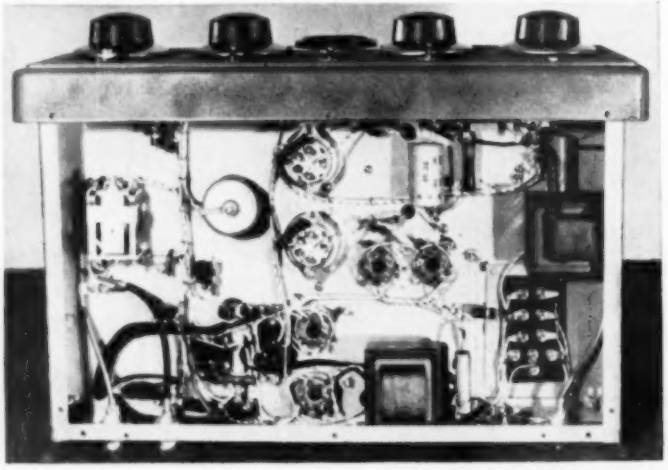
The three self-contained power supplies furnish all operating voltages, plus regulated power for the exciter. The high voltage power supply uses a single 5R4GY, the high vacuum type being preferred over mercury vapor rectifiers to prevent the radiation of "hash." The filter choke and plate meter are connected in the "B-minus" lead to reduce the shock hazard. A double-pole, double-throw antenna relay is installed under the chassis to switch the antenna to the receiver coax and open the high voltage transformer center tap when S_1 is thrown. The output condenser, C_{31}, on the high voltage power supply should have a capacity of at least 8 mfd., not because of hum, but to assure low output impedance to supply the peak currents to the class B r.f. amplifier. The high voltage should measure 750 volts.

The low voltage supply delivers 300 volts to the 6AG7 and the 807 screens. It is important that this voltage be within five per-cent of this value. The transformer used in this unit had a rather low a.c. voltage output, so a 5Z4 rectifier was used. This tube has a very low internal voltage drop. Most small transformers of the type suitable for T_1 deliver about 350 volts a.c. each side of center tap, so the d.c. output would probably exceed 300 volts. If this is the case, a 5Y3 rectifier could be substituted to reduce the d.c. output. S_1 opens the center tap of the low voltage supply on standby. An additional switch, S_{1b}, closes only the low voltage supply center tap through a resistor, leaving the high voltage off. This gives a low voltage to the exciter for spotting the exciter signal in the receiver, while the voltage is too low to harm the screens of the final amplifier. Two VR105 tubes are used to stabilize the exciter "B" supply voltage.

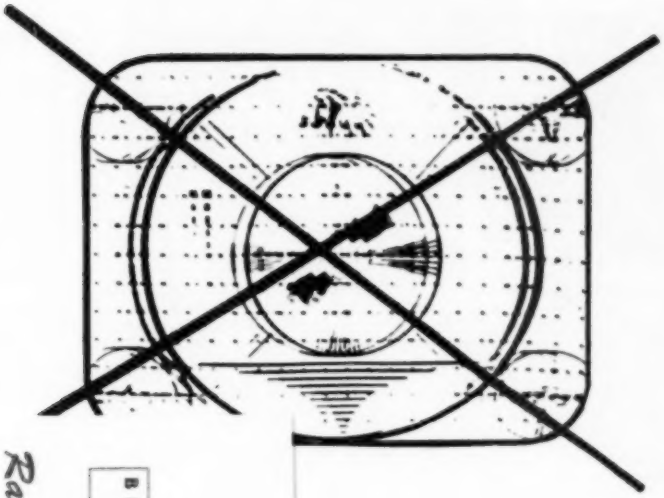
The bias supply is turned on by the line switch, S_1, and remains on at all times. This supply uses a half-wave selenium rectifier so the bias appears almost instantly when the transmitter is turned on. T_2 should have a secondary voltage of between 50 and 110 volts. Because of the half-wave rectifier, it is possible to vary the bias over a wide range merely by adjusting the load resistor, R_8. Transformers of this type are rather scarce, but a filament transformer operated backwards from the filament supply will make a satisfactory substitute. The value of R_8 is adjusted to provide a bias voltage of approximately 30 volts on the 807's. The best way to adjust this resistor is to set its value at the point where the total plate current with no excitation is 60 ma. to the two final tubes. The plate voltage should be 750 or near this value, and the screens should be set at 300 volts. A variable slider type resistor may be used for R_8 in determining this resistance, after which a fixed resistor of the proper value may be permanently wired in. About 500 ohms is the maximum value of resistance which should be used to avoid poor regulation of the bias voltage.

Tuning the transmitter is quite simple. One precaution—don't try to operate the 6AG7 as a doubler. The harmonic output of a class A stage is practically nil and if you are getting excitation to the final from the driver as a doubler you have too much excitation to the 6AG7. Of course you cannot double an AM signal. For c.w. and FM, the transmitter is tuned in the usual manner, adjusting the swinging link to load the final to about 200 ma. or 150 watts input. After the rig is tuned up it is good practice to reduce the r.f. gain control until the output just begins to drop off. This will in-

Under chassis view. The selenium rectifier disc is mounted under the chassis with the antenna-power supply switching relay. An unpainted chassis is recommended.



what's wrong with this picture?



Television service can be speeded up by correct diagnosis of test patterns. HOW TO INTERPRET WHAT YOU SEE reveals how one leading manufacturer has obtained good results from this type of circuit analysis. Actual photographs illustrate effects of circuit faults on picture quality.

plus—in the big April Issue:
14 other important articles, including:

A SINGLE-SIDEBAND TRANSMITTER ADAPTER which can be used as a companion unit to the "Low-Cost Exciter Unit," and the "150-Watt Universal R. F. Amplifier" as discussed on page 53 of this March issue.

CRYSTAL DIODES IN MODERN ELECTRONICS. A continuation of the series on crystal diodes. This article deals with their use for sync stripping in television receiver circuits.

SERVICING NOISE-REJECTION CIRCUITS. Down-to-earth, "how to fix it" instructions covering one important television receiver servicing problem.

A HIGH QUALITY AUDITORIUM AMPLIFIER. Construction data on a p.a. unit which features two mike inputs, a radio input, and a master mixer.

A MOBILE 75 METER V.F.O. For the ham who operates mobile. This article gives complete construction details on a compact unit which covers the 75 meter band.

BUSINESS REPLY CARD
No Postage Necessary if Mailed in U. S. A.
3c Postage will be Paid by

Radio-Electronic Engineering
EDITION OF RADIO & TELEVISION NEWS
366 MADISON AVENUE
NEW YORK 17, NEW YORK

FIRST CLASS
Permit No. 37110
Sec. 34.9, P. L. & R.
NEW YORK, N. Y.

TELEVISION NEWS
A ZIFF-DAVIS PUBLICATION

Publishers also of: RADIO-ELECTRONIC ENGINEERING Edition of RADIO & TELEVISION NEWS • PHOTOGRAPHY
PHOTOGRAPHY ANNUAL • FLYING • MODERN BRIDE • FICTION GROUP • ZIFF-DAVIS COMICS

CATALOGUE SPECIALS

NOVICE CW TRANSMITTER

Here's a neat and compact surplus item which runs verbs very simply to 47/50-3150 RC crystal controlled. Condition? Guaranteed reliable. Instructions? Yes, we furnish them! Complete conversion, step-by-step, nothing left to guesswork. This is DC-4/ART-13 command transmitter that has been used a lot with ham-hours. By the time this ad appears the BC-457, described in November QST, will be all gone, so we worked out and offer the BC-459. If you don't wait until there are all gone! ONLY $7.95

APN-1 WOBBULATOR

(See Dec. Radio & TV News)

Now you can build that VERSATILE SWEEP FREQUENCY GENERATOR. We've arranged to acquire only 100 of the APN-1 magnificent units at the [illegible] With reprint of the article $9.95

BROADCAST BAND & AERO

MN-26-C Remote Controlled navigational direction finder and communication receiver. Manual DF in any one of three freq. bands, 150 to 1500 KC. 24 V. Self contained dynamotor supply. Complete installation, including receiver, control box, loop, azimuth control, Left-Right Indicator, plugs, loop transmission line, and flex. shafts.

BRAND NEW, ORIG. PACK $69.50

MN-26-C alone, New $39.50

MN-20-E BENDIX LOOP

Here is a dandy! Use as a remote-controlled loop with MC-124 flexible shaft, or mount a lightweight beam on the 12-inch dia. turntable. Hand with handle gears are 15:1 ratio. Originally used with MN-20 or -26-C/DF. BRAND NEW and CLEAN.

Special, ONLY $9.95

MC-124 flexshaft, will stop length cleaned to [illegible] ..... 30c ft.

MN-52 crank drive with azimuth scale, for [illegible] $2.50

MARINE RADIOMEN

Send now for our latest Marine Catalogue describing and pricing the famous "G.L. MARINER" transmitters, receivers, and Direction Finders.

4 USES—4 DOLLARS

The most versatile dynamotor in surplus! The best dynamotor for conversion to 6 V. Multiple windings, for operation at 6 volts at 100 or 350 v at 50 MA or 250 v at 100 MA. No brushes to shift around, no mechanical work. Or use it as 1 or 2 amp input or step-down transformer for 6 volts! Changes 6 to 12, or 12 to 24, or 24 to 6 volts, up to 2 amps as a GENERATOR. Turn with motor, get 12 v DC at 1.0 A or 24 v DC at 0.5 A. Or, for 6 V input, the 4 diodes easily removable self-contained unit connected for full wave rectification. Complete data sheet furnished. BRAND NEW $4.00

PRECISION CALIBRATED TUNER

Build a q-meter or an audio oscillator, a signal generator, a VFO, an ultra-stable receiver, or what you want. 10 kc-calibrated accuracy and resolution. 3 gang condenser assembly with 4" precision dial etched 3.5-12 mc in 3 bands plus a reference mark. Triangular plastic flatline indicator. 50:1 ratio drive assembly. All gears are hardened double-section. Bar-type ball bearings. Plates are two single spaced 250 mfd. and one double-spaced 365 mfd section. Double-bearing spread section to eliminate drift. All are ceramic insulated. Neat and compact. Note price is a lot of money for this unit! Now check our pack from bulk spares. Was the VFO tuner for Collins 70S unit. We furnish free schematic complete TCS-12 with this. ONLY $4.95

NEW CARBON MIKE

A little gem! Same impedance as T-17, not held in the palm of your hand. Nice flexible cord with standard 3-circuit plug. Press-to-talk switch. New shipment. BRAND NEW $2.79

COMMAND EQUIPMENT

With free dope sheets and schematics

RECEIVERS

BC-455, 6.0 mc. NEW $12.95, GOOD USED $7.95

TRANSMITTERS

T-19 ARC-5, 3.1 mc. Excellent $17.95
BC-457 or T-20 ARC-5, 4.1-5.3 mc. Like new 12.95
BC-458 or T-21 ARC-5, 5.3-7.0 mc. Excellent used 7.95
T-23 ARC-5, VHF, 100-156 mc. Excellent used 24.95
Control Unit, less tubes 5.95
MOD BC-459, Brand new $5.95. Excellent used 7.95
As is, for parts 1.29
274N PLUG, 7-prong male plug to fit back of command units, and units. This is the same plug as used in the ARC-5. Each $1.00, Box 10 ..... $1.00
Local Control Adapter Parts for 274N or ARC-5 receiver. Exact pot, gasket, knobs, etched plate, and instructions. Ready to assemble $1.29
SPLINE TUNING KNOB 75c

9 TO 13 VOLT TRANSFORMER OR LINE VOLTAGE BOOSTER

Tapped transformer. Input 115 v 60 cy, 9 to 13 volts out in 1 volt steps at 3 amps. Our free catalog shows lots of uses. NEW $1.89

HI-FI DYNAMIC HEADSET!

A lucky purchase from Turkey. This is the DYNAMIC set, using waterproof fiber cones, which gives absolutely best music reproduction flat from almost nothing to beyond 10,000 CPS. Permeflux field price new is $40.00 per set! These have large chamois cushion ear pads, are lightweight and comfortable, with dual fasteners for cleaning. Mis-matching impedance 10-2 ohms, with 4 ft. cable. Plugs [illegible] $4.95

FREE! NEW CATALOGUE!
Interesting, Descriptive. Nothing but Bargains! Send for It Now!

AUDIO SUPER-SPECIALS

SUPER HI-Q high cut choke, 0.65 H, 55 ohms DC. Tune with .001-.002 MF. ONLY 99c
LOW CUT, 7.5 H, 295 ohms. Tune with 1 MF, or use as 50 mc filter choke. ONLY 99c
OUNCER Transformers, push-to-talk to push-pull grids [illegible] ..... other for push-pull outputs, tapped sec. [illegible] with resistors, condensers, etc. BOTH FOR ONLY $2.29
PHASE SPLITTER, or low-level mixer, or hybrid or push-pull input. Has [illegible] push-pull 1:1 for any tube essentially flat 100-15,000 CPS. BRAND NEW, ONLY 69c
ONE OF EACH OF ABOVE, ALL FOR $4.00

G.L. ELECTRONICS

905 S. Vermont Ave., Los Angeles 6, Calif.
All Prices F.O.B. Los Angeles. Calif. Buyers Add Sales Tax

R. F. Amplifier

(*Continued from page 55*)

The three self-contained power supplies furnish all operating voltages, plus regulated power for the exciter. The high voltage power supply uses a single 5R4GY, the high vacuum type being preferred over mercury vapor rectifiers to prevent the radiation of "hash." The filter choke and plate meter are connected in the "B-minus" lead to reduce the shock hazard. A double-pole, double-throw antenna relay is installed under the chassis to switch the antenna to the receiver coax and open the high voltage transformer center tap when S_1 is thrown. The output condenser, C_{10}, on the high voltage power supply should have a capacity of at least 8 mfd., not because of hum, but to assure low output impedance to supply the peak currents to the class B r.f. amplifier. The high voltage should measure 750 volts.

The low voltage supply delivers 300 volts to the 6AG7 and the 807 screens. It is important that this voltage be within five per-cent of this value. The transformer us
rather low a.c.
rectifier was u
very low inter
small transform
for T_1 deliver a
side of center
would probabl
this is the cas
be substituted
put. S_1 opens t
voltage supply
tional switch,
voltage supply
resistor, leavir
This gives a lo
for spotting t
receiver, while
to harm the sc

fier. Two VR105 tubes are used to stabilize the exciter "B" supply voltage.

The bias supply is turned on by the line switch, S_1, and remains on at all times. This supply uses a half-wave selenium rectifier so the bias appears almost instantly when the transmitter is turned on. T_1 should have a secondary voltage of between 50 and 110 volts. Because of the half-wave rectifier, it is possible to vary the bias over a wide range merely by adjusting the load resistor, R_8. Transformers of this type are rather scarce, but a filament transformer operated backwards from the filament supply will make a satisfactory substitute. The value of R_8 is adjusted to provide a bias voltage of approximately 30 volts on the 807's. The best way to adjust this resistor is to set its value at the point where the total plate current with no excitation is 60 ma. to the two final tubes. The plate voltage should be 750 or near this value, and the screens should be set at 300 volts. A variable slider type resistor may be used for R_8 in determining this resistance, after which a fixed resistor of the proper value may be permanently wired in. About 500 ohms is the maximum value of resistance

Enter A Subscription For:

RADIO-ELECTRONIC Engineering

EDITION OF
RADIO & TELEVISION NEWS



NAME

ADDRESS

CITY ZONE

STATE

POSITION

COMPANY

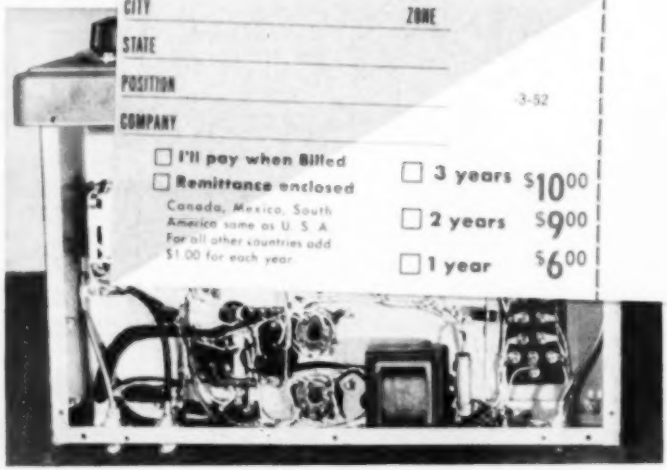
3-52

☐ I'll pay when Billed
☐ Remittance enclosed

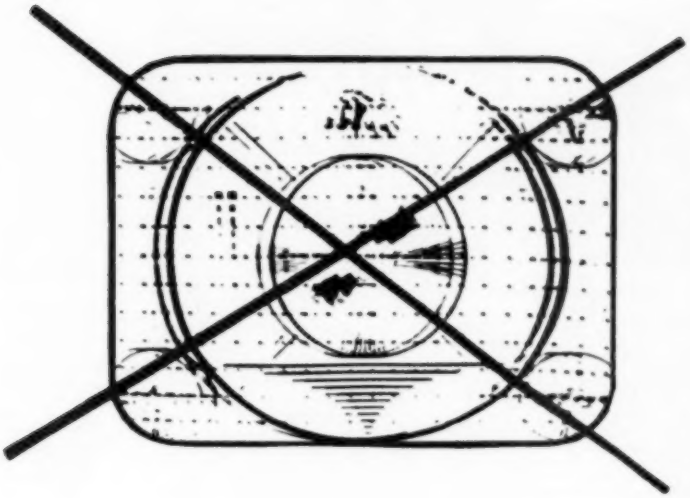
Canada, Mexico, South America same as U. S. A. For all other countries add $1.00 for each year.

☐ 3 years $10.00
☐ 2 years $9.00
☐ 1 year $6.00

Under chassi
the antenna-



what's wrong with this picture?



Television service can be speeded up by correct diagnosis of test patterns. HOW TO INTERPRET WHAT YOU SEE reveals how one leading manufacturer has obtained good results from this type of circuit analysis. Actual photographs illustrate effects of circuit faults on picture quality.

plus—in the big April Issue:
14 other important articles, including:

A SINGLE-SIDEBAND TRANSMITTER ADAPTER which can be used as a companion unit to the "Low-Cost Exciter Unit," and the "150-Watt Universal R. F. Amplifier" as discussed on page 53 of this March issue.

CRYSTAL DIODES IN MODERN ELECTRONICS. A continuation of the series on crystal diodes. This article deals with their use for sync stripping in television receiver circuits.

SERVICING NOISE-REJECTION CIRCUITS. Down-to-earth, "how to fix it" instructions covering one important television receiver servicing problem.

A HIGH QUALITY AUDITORIUM AMPLIFIER. Construction data on a p.a. unit which features two mike inputs, a radio input, and a master mixer.

A MOBILE 75 METER V.F.O. For the ham who operates mobile. This article gives complete construction details on a compact unit which covers the 75 meter band.

subscribe today

use the order card facing this page



It's your lowest-cost invitation to highest-caliber electronics guidance: in Radio, Television, Servicing, Research, Amateur, Radar.

RADIO & TELEVISION NEWS

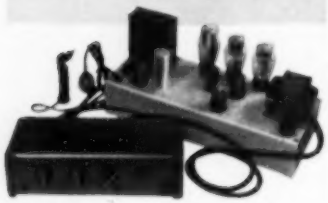
A ZIFF-DAVIS PUBLICATION

Publishers also of: RADIO-ELECTRONIC ENGINEERING Edition of RADIO & TELEVISION NEWS • PHOTOGRAPHY PHOTOGRAPHY ANNUAL • FLYING • MODERN BRIDE • FICTION GROUP • ZIFF-DAVIS COMICS

get the best in Hi-Fi

get a BROOK

...at ALLIED

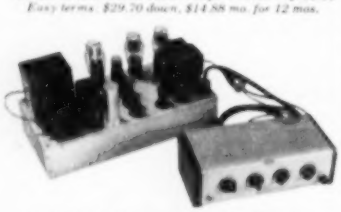


BROOK 12A3 AMPLIFIER AND PREAMP

10-watt amplifier. Low mu triodes in all stages. Response: ±0.5 db, 20-20,000 cps; hum, 75 db below 10 watts. Brook transient peak circuit permits high output (over 10 watts) without increase in distortion. Distortion at full output: 1.21%; total harmonic, 2.56%; intermodulation. Controls: Bass (26 db boost) and treble, input selector switch, gain. Pre-amplifier controls and inputs housed in separate remote consolette. Inputs: 1 tuner or TV; 2 magnetic phono. Outputs: 1.5 to 24 ohms tapped, with separate 500-ohm winding. With 9 tubes and 5U4G rect., 6 ft cable. For 110-125 volts, 50-60 cycles AC. Drain, 110 watts. Size: amplifier, 17 x 6¼ x 8½"; preamp., 12¾ x 6¼ x 3¼". Wt., 28 lbs.

97-866. Brook Model 12A3 complete. *Net* . . . $198.00

Easy terms: $29.70 down, $14.88 mo. for 12 mos.



BROOK 10C3 AMPLIFIER AND PREAMP

30-watt, ALL-TRIODE amplifier. Main unit consists of amplifier with power supply; remote control consolette contains pre-amplifier with controls, inputs and power switch. Response overall: within 0.5 db, 20-20,000 cps at all levels. Distortion at 30 watts: 1.30%; total harmonic: 1.69%; intermodulation. Hum level 75 db below full output. Controls: Separate bass (26 db boost) and treble; input selector; gain. Inputs: 2 for tuners, 2 with equalized preamp for magnetic cartridges. 1 high-gain for mike. Outputs: Tapped from 1.5 to 30 ohms with separate 500-ohm winding. With 13 tubes and 5U4G rectifier, 6-ft. cable. Amplifier, 17 x 8½ x 8"; preamp., 13 x 6½ x 4". For 110-125 v., 50-60 cycles AC. Drain, 125 watts. Shpg. wt., 50 lbs.

97-865. Brook Model 10C3 complete. *Net* . . . $315.00

Easy terms: $47.25 down, $23.66 mo. for 12 mos.



FREE 212-PAGE CATALOG

Send for Radio's leading Buying Guide featuring world's largest stocks of high-fidelity components, plus everything in Radio, TV and Industrial Electronics.

ALLIED RADIO

ALLIED RADIO CORP., Dept. 1-CB-2
833 W. Jackson Blvd., Chicago 7, Illinois

☐ Send FREE 212-Page ALLIED Catalog
☐ Ship the following Brook equipment:

$_____ enclosed (Full Payment).
☐ Down Payment enclosed.

Name _____

Address _____

City _____ Zone _____ State _____

sure low harmonic output. To adjust the transmitter to amplify AM, excitation without modulation is first applied and the transmitter adjusted for maximum output with plate current of not over 240 ma. The r.f. gain control is then reduced until the plate current drops to 120 ma. and the adjustment is complete. Modulation of the input signal with speech should cause the r.f. output to increase approximately 25 per-cent as indicated by a pilot bulb coupled to the antenna tuner. Power input when amplifying AM is limited to about 90 watts. To amplify single-sideband, the transmitter is first tuned up with carrier input only to an input of 180 watts. The carrier injection is then reduced to completely balance out so that the resting plate current of the 807's is 60 ma. The single-sideband signal is then set at the proper level with the r.f. gain control so that voice peaks will give peak currents of 240 ma.

The universal amplifier has been very satisfactory in operation on 80, 40, and 20 meters with the "A Low Cost Exciter Unit" described in the February, 1952 issue of RADIO & TELEVISION NEWS. On ten meters, the TVI-proofed FM exciter described in February, 1951 "*CQ*" has been used with excellent results. The SSSC adapter, for use on 20 and 75 meters, is inserted between the exciter and the universal amplifier. This unit will be described in a forthcoming article. —30—

EXTENSION TEST LEADS

By H. LEEPER

WHILE certain loosely coiled test leads are on the market, for a real compact set of leads try a short length of coiled cable, obtainable from some representative of Western Electric Company.

The coiled cable shown in the photograph is only 7 inches in length and was purchased at a camera shop, which sells the cord for flash guns.

With proper terminals and test prods attached, such twin conductor cable may be pulled out as much as 30 inches and it will then return to original form keeping leads from under foot as ordinary leads usually are found. —30—

Coiled cords make handy service test leads.



RADIO Surplus Buys



CRYSTALS

. . . in FT 241-A Holders—½" Pin SPC. Marked in 54th OR 72nd Harmonic MC Freq. Listed below by fundamental frequency with fractions omitted.

500 KC Crystals only. Limited Quantity . . ea. **$1.95**

372	411	487	400	462
374	413	488	440	463
375	413	490	442	464
377	414	491	444	466
379	416	492	444	466
381	418	493	446	468
383	420	494	448	470
384	422	495	448	470
385	423	496	450	472
387	424	497	451	474
388	426	498	452	475
390	427	503	453	476
391	429	504	455	477
392	431	507	456	479
394	433	509	457	480
396	435	511	459	501
398	437	512	461	505
401	438	514		
403	481	516		
405	483	523		
407	484			
409	485			

40c ea. or 10 for $4.50 — 99c ea. or 10 for $9.00

TUNER FROM NAVY "BN" EQUIPMENT



Simply modified into 2 meter converter for use of communications receiver. Uses 1—6J6, 1—6SH7, 1—6H6, 1—615 (Not Furnished).

Slug is tuned from 117 to 187 Megacycles. Includes schematic diagram for BN equipment.

Now—A New LOW Price **$4.95**

SENSITIVE ALTIMETERS



Pioneer, Kollsman, and Bendix Sensitive Altimeters. Range 0-35,000 ft., reading in feet. Barometric setting adjustment. No hook-up required . . . mounts easily in auto or aircraft.

Used, Good . . . Each **$12.95** Postpaid

ALTIMETER, AIRCRAFT



U. S. Navy surplus Altimeters, range 0-10,000 feet. Adjusts to sea level setting of terrain. Simply installed, requires no hook-up . . . for auto or aircraft installation.

BRAND NEW . . . Each **$7.95** Postpaid

POWER TRANSFORMER

Primary 125 volts tapped at 105 and 115 volts, 50 to 62 cycles. Secondaries: 640 v. at 3.0 amps; 320-0-320 v. at 0.125 amp., 6.4 v. at 8 amps., 6.4 v. at 10.5 amps., 2.5 v. at 3.5 amps., 4.60 v. at 0.005 amp., 2.5 v. and 4,000 volt windings insulated for 6000 volts. All other windings insulated for 1500 volts. Cost government more than $12.00—a real bargain at . . . **$4.95**

ALL EQUIPMENT F.O.B. PASADENA UNLESS OTHERWISE SPECIFIED. PLEASE ENCLOSE FULL AMOUNT WITH ORDER

C & H SALES CO.

BOX 356-MT, East Pasadena Station, Pasadena 8, Calif.

Another Outstanding Jobber

THE LUKKO SALES CORP.

5024 IRVING PARK RD. CHICAGO 41, ILL.

has all 17 KITS & INSTRUMENTS in stock!

EICO



See EICO ad on Page 117

CODE SENDING RECEIVING SPEED

HIGH SPEED WITHOUT NERVOUS TENSION

REVEALING BOOK shows how "Speed" operators develop high speed and proficiency. Learn code for Amateur or Commercial Radiotelegraph. Increase, or improve your sending and receiving with the Candler System which develops radio telegraph experts and code champions.

CANDLER SYSTEM CO., Box 928, Dept. 3-C, Denver, Colo.

FREE BOOK

International Short-Wave

(Continued from page 110)

Gold Coast—Although some sources report Accra using 15.43, in a recent QSL the station said is using *only* 6.049, 4.915; 6.049 is scheduled 0528-0700 and 4.915 at 1013-1330 (Saturday 1043-1330). (Ridgeway, South Africa) Pearce, England, reports the 4.915 channel now closing 1300; has Gold Coast news 1245. According to a station announcement, Gold Coast Time now is the same as *GMT* (5 hours *ahead of EST*), Pearce reports; formerly was *GMT plus 30 minutes.*

Greece—A *new* Armed Forces Station at Khios has been heard in Sweden on 6.590 at 1400-1700. "The Voice of Greece," Athens, now broadcasts to North America 2000-2100 on 7.300, with news 2035-2045A. Programs in Russian are transmitted on 15.345 at 0915-0930; these additional programs are radiated on 7.300—1030-1300 Greek; 1300-1400 Balkan languages; 1430-1445 *English;* 1445-1500 French, and 1530-1700 Greek. (Radio Sweden)

Greenland—Radio Sweden says Gronlands Radio, Godthaab, has replaced 5.942 with 7.094 according to verification card recently received; programs are daily 1630-1845.

Guatemala—TGDA, 7.471, Quetzaltenango, noted with announcement by man as "Radio La Voz de Occidente;" signed off 2203; is audible almost every evening *after* 1900 but is difficult to find due to QRM. (Machwart, Mich.) TGTA, 6.335, noted with musical program 2130-2200. (Sutton, Ohio) TGWA, 9.758, noted ending *English* programs Mon., Wed., Fri. at 1930. (Niblack, Ind.) TGLA, 6.295, Guatemala City, heard 1950-2035; all-Spanish. (Patterson, Ga.) TGNA, 11.85, is fine level in Mass. in *English* 2200-2230. (Van Gilder) Still noted on 9.668 (parallel 11.85) on Wednesdays with Mail Bag in *English* 2230-2300A. (Hoffman, N. Y.)

Haiti—4V2S, 5.950, Port-au-Prince, heard 1900-2000 with fair level but some QRM. (URDXC) Leary, Ind., reports 4VRW, Port-au-Prince, now on 9.965A at 1800. Also is noted mornings; is a "wanderer."

4VPL, *Radio Petionville*, is still using 8.995; is heard by 1600 and probably still signs off 2200; weak with much QRM. (Stark, Texas) 4VWA, 6.300, Cap-Haitien, noted recently 1800-2100 sign-off; 4VCN, 6.406, *Radio Fides*, Port-au-Prince, noted at fine level 1830-2100 sign-off. (Saylor, Va.)

Holland—Latest Hilversum schedules for *English* broadcasts are 0530-0610 to Australia, New Zealand, Pacific Area, 21.48, 17.775, 15.22, 6.025; 1100-1140 to South Asia, 11.73, 9.59, 6.025; 1500-1540 to Africa, Great Britain, Ireland, Continental Europe, 11.73, 9.59, 6.025; 2130-2310 to United States, Canada, 9.59, 6.025. The *"Happy Station Programs,"* produced and presented by Eddie Startz, are Sundays *(only)* at 0530-0700 to Far East Pacific Area,

For Direct Drive Circuits...

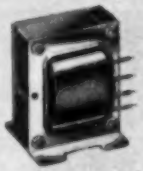
New STANCOR TELEVISION REPLACEMENT COMPONENTS



DY-10
ANTI-ASTIGMATIC DEFLECTION YOKE
A high efficiency yoke with cosine distributed windings, ferrite core and nylon bobbins. Replacement in 34 RCA TV models, 30 Emerson models and 7 Capehart models.

A-8131 AIR CORE "FLYBACK"
Companion unit to DY-10 in direct drive circuits and used in same models. See Stancor Bulletin No. 389 for a complete list of these 71 models.

A-8140 VERTICAL OUTPUT TRANSFORMER
Has primary:secondary ratio of 44:1. Replaces RCA No. 74950 in 35 TV models, Emerson No. 738044 in 30 models and Capehart No. 650238A-1 in 7 models. These models are listed in Stancor Bulletin No. 390. Ask your distributor for a free copy.

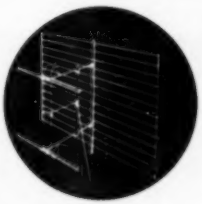


STANCOR

Stancor transformers are listed in Howard Sams' Photofacts Folders

STANDARD TRANSFORMER CORPORATION

3584 ELSTON AVENUE • CHICAGO 18, ILLINOIS



"Positively Amazing Performance!"
is what they are all saying about the new ALL-CHANNEL

GONSET "RADARRAY"
"Model C"

High gain and front-to-back ratio on all 12 channels. No side lobes. Ideally suited where maximum gain is required on several channels, or where ghosts, co-channel or adjacent channel interference problems exist in combination. Eliminates or greatly reduces oscillator interference troubles.

Ruggedly constructed yet light enough to be used on a rotator. Another engineering achievement by the originators of prefabricated open-wire line for T-V. Write for our "Fringe Area" brochure.

available at most dealers

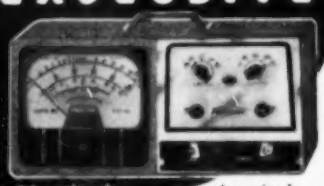
GONSET

GONSET CO. 801 S. MAIN ST BURBANK, CALIF.

PRECISE

EXCLUSIVE

deluxe VTVM
with 7½" meter
for Horizontal or Vertical construction



also wired

Only PRECISE makes this deluxe VTVM KIT! Includes famous PRECISE Reflex Circuit for increased stability and greater accuracy. Build it horizontally or vertically to fit your own bench requirements.

Etched panel; 15 ceramic resistors; unplotted connectors; separate 3 V. AC scale; Tubes: 1A5, 6X5, 6SN7; fine zero adjust; huge 7½" meter for more accurate reading; Center rapid construction book explains each step. Complete with test & test lead.

Ranges: DC 0-2.5-25-250-500-1000 V.
DC 0-5-25-250-500-1000 V.
AC 0-5-25-250-500-1000 V.
Ohms: 0-1, 0-10, 0-100, 0-1000, 0-10,000, 0-1,000,000 ohms.
DB: From —20 to +55 DB.

PRECISE Kit Model 907-K $38.98*
Factory Wired, Model 907 ..... $57.98*
Lowest Price for this LARGE METER!

PRECISE High Voltage Probe has no equal! No other probe offers so much; every feature . . . PRECISE exclusives . . . makes it the most practical, foolproof and sturdy High Voltage Probe in the industry today.

Multiple insulation; Mechanically shockproof construction; Interchangeable tips; Metal lead connection; Interchangeable resistor; Triple flash guards; Sturdy non-porous shell.

PRECISE Model 999 (Wired only) $6.98* Complete

New PRECISE Vacuum Tube Voltmeter. By comparison your best value. All the unusual advantages of the PRECISE Model 907 (above) with 4½" meter. Complete with btry. & test lead.

PRECISE Kit Model 909-K $25.98*
Factory Wired, Model 909 ..... $44.98*

Newest R.F. Probe! Lowest Price! Greatest Value!

Time-tested circuit. Special 600 percent rare, 1 ma permanent crystal rectifier up thru 250 megs. Probe handle terminates in an amphenol connector—offers end of shielded cable available in either amphenol phone plug or phone tip type fitting at no added cost. Individually instrument tested.

PRECISE Model 812 (Wired only) $4.25*

All instruments carry the PRECISE Guarantee; components produced by RMA Warranty. . . . Write for FREE catalog No. 51

BE SURE TO SEE THE COMPLETE PRECISE LINE AT YOUR JOBBER NOW!
*Prices slightly higher in the West.

PRECISE DEVELOPMENT CORP.
Oceanside L. I. New York

It COUNTS and CARRIES your TUBES



Specially designed for the television serviceman. Makes work easier and quicker—and YOU more efficient.

You take INVENTORY AT A GLANCE—and always have the right tube with you.

Thin, easy-to-carry leatherette cabinet, 20½" x14" x9" deep. Holds up to 249 tubes, or less with space for TOOLS and METER. Clips in cover for price list or mirror.

Ask your parts jobber how it can PAY FOR ITSELF in 5 WEEKS, or write

$13.50 Net to Dealer Higher on West Coast

Also TV Cabinets, Wall Baffles

ARGOS PRODUCTS CO.
310 MAIN STREET • GENOA, ILLINOIS

=i LEARN CODE

No matter how difficult it has been for you to learn code before, I guarantee that you will memorize the Morse International Code in two hours or return method within 5 days and I will refund your money. Get in on the fun of "ham license" civilian radio. Send one dollar for complete method. NOTHING ELSE TO BUY!

OTTO LUTHER, NEW PRESTON, CONN.

New Low Prices On WELLER SOLDERING GUN

Now you can have instant heat at the moment you pull the trigger. No waiting. No wasted time or current. And look at these new low prices!



WS-100	single heat 100	60	115	$8.77	STUDBITTM No. 7535 Package of 3—25c
WD-135	dual heat 100-135	60	115	$10.73	
WS-200	single heat 200	60	115	$9.76	DIXIBITTM No. 7536 Package of 2—35c
WD-200	dual heat 200-250	60	115	$11.72	

10% CASH WITH ORDERS

ALMO RADIO CO.
509 ARCH ST. & 6705 MARKET ST.
Philadelphia, Pa.
6th & ORANGE STS. • Wilmington, Del.
6801 VENTNOR AVE. • Atlantic City, N. J.
1133 HADDON AVE. • Camden, N. J.

Europe, 21.48, 17.775, 15.22, 6.025; 1100-1230 to Near and Middle East, Europe, 11.73, 9.59, 6.025; 1630-1800 to South and Central America, 11.73, 9.59, 6.025, and 2130-2300 to North America, 9.59, 6.025.

Honduras—HRP1, 6.351, San Pedro Sula, noted with good level when tuned 2245; announcements in *English* with North American recordings; at 2256 had closing announcements and asked for reports; strong signal in North Carolina. (Ferguson) La Ceiba, 6.235A, signs off 2200. (Stark, Texas) HRXW, 8.982A, Camayagua, noted 1730-1800. (Foerster, Ill.) HRA, 5.925, Tegucigalpa, heard 2000-2245 with music and speech; all-Spanish. (URDXC)

Hong Kong—ZBW3, 9.525, noted 0500 in language by man; heavy QRM. (Winch, Calif.) Heard in South Africa 0900 relaying Radio Newsreel from the BBC, London; closes 1030 with weather report and "God Save the King." (Ridgeway)

Hungary—Radio Budapest noted 1615 in *English* on 6.247A and 7.222A. (Leary, Ind.) Other channel in use is 9.833A which usually has bad QRM from Cuban now on that spot.

Iceland—TFJ, 12.174, noted a recent Sunday signing off 1124. (Catch, England) Is now scheduled (Sundays *only*) at 1115-1130A. Formerly ran 1115-1145. (Oskay, N. J.)

India—AIR is now sending out a QSL card, showing the Parliament Building. (Machwart, Mich.) The 1030 news noted on 4.940; 3.495 carries native at that time; noted closing on 4.940 at 1330; and signing on in *English* for Europe 1400 (runs to 1515 now) on 5.990, 7.190, 7.170. Heard on 9.72 with Indonesian music at 1745 tune-in; closed 1800 after announcements in *English*. (Pearce, England) AIR noted on 7.21 at 0345-0415; at 0334-0345 played interval song repeatedly. (Stein, Calif.) Heard on 7.18A around 0730 with woman announcer in *English*, fairly strong signal in New York State. (Chatfield) Leary, Ind., reports AIR on 15.160 at 1630 with good level.

The 0730 news on *measured* 15.380. (Ferguson, N. C.) And heard here in West Virgina parallel on 17.740.

New channels for AIR's External Services include 3.250, 5.960, 7.125, 9.530. (*WRH Bulletin*) AIR, 21.70, has news 0300, is high level in South Africa. (Ridgeway)

Indo-China (*Vietnam*)—"La Voix du Vietnam" noted near 7.090 from 1800 when has news in French; in oriental language 1830. (Pearce, England) This one noted 0645 at good level. (Ferguson, N. C.) Saylor, Va., reports *Radio Dalat* 0130-0145 sign-off, good level on occasion.

Iran—Radio Tabriz is again noted on 6.090A with *English* lesson weekdays 1215-1230. (*WRH Bulletin*) Heard in New York 2340 in native. (Bellington)

Iraq—Radio Baghdad, 11.724, noted 2300 signing on, S7 with preamplification in use; man chanting; good to 2330. (Oskay, N. J.)

Israel—"Voice of Israel," Israeli

Broadcasting Service, Box 1082, Jerusalem, Israel, now has an attractive verification card. (ISWC, London; Tel-Aviv, 9.010A, noted in *English* 1630-1715 sign-off. (Hoffman, N. Y., others) Has news 1430 now on both 9.010A, 6.833. (Pearce, England)

Italian Somaliland—Mogadishu, 7.383, is broadcasting daily 1115-1300 and is heard in South Africa; Arabic 1115-1200 when goes into Italian after set of two-toned chimes; chimes strike 7 o'clock local time; plays recordings 1200-1225 when woman gives news in Italian; continues with recordings to closedown 1300 after station call; identifies in Italian 1115, 1200, 1225, 1300 sign-off; sometimes has QRN but usually is in clear. (Ridgeway)

Italy—Rome has been noted afternoons in Italian on 7.10A; strong signal when has no CWQRM; *no English noted.* (Chatfield, N. Y., others) Heard with *English* 1400-1430 on 11.810. (Sutton, Ohio) Rome noted with *English* for South Africa on 11.81, 9.63 at 1505, off 1530 in *English*; heard on 11.91 with *English* for Far East 0515-0615, another day noted signing on to Far East at 0545 on 11.91, 15.400, 17.80, had news 0600. (Pearce, England)

Jamaica — Radio Jamaica, 4.950, signs on around 0630 with march; a program of popular recordings follows. (Newcomb, Mo.) The 3.360 outlet is good evenings; runs to 2300A. (Leary, Ind.)

Japan—At the time this was compiled, *Radio Tokyo* had not yet resumed its Overseas Services although press dispatches from Tokyo indicated resumption was to have been effected not later than late December. According to *Radio Australia*, plans call for two 50 kw. transmitters for the Overseas Services; tentative schedules call for 0000-0100 to North America in the 49- and 31-m. bands; 0600-0700 to North China and 0700-0800 to Central China on two channels in the 49-m. band; 0900-1000 to Philippines and Indonesia in the 31- and 25-m. bands; 1040-1140 to India in the 25- and 31-m. bands.

JBD3, 15.225, and JBD4, 15.235, noted in parallel with "NHK" programs around 2330-2345. (Ridgeway, South Africa) JKI, 4.910, noted 0530 with "NHK" identification; JKJ, 7.285, heard 0355 with operatic recordings and announcing "NHK" at 0359. (Winch, Calif.)

Kashmir—Radio Kashmir, Srinagar, which recently changed frequencies, now can be heard 2130-2330, 0630-1200 on 3.335 and 0100-0230 on 6.110, according to a *WRH Bulletin*.

Kenya—Nairobi, 4.855, now appears to close at 1500; ends session with "God Save the King" after time pips; formerly ran to only 1400 except on Wed., Sat. (Pearce, England)

Korea (South) — HLKA, 7.933A, noted recently 0700-0730 with weak signal, in native. (Stein, Calif.)

Lebanon—Beirut, 8.035A, is audible with recorded music 1455-1515; has bad CWQRM. (Sutton, Ohio)

Liberia—ELBC, 6.025, Monrovia, still

NEW Automatic Radio CUSTOM-BUILT AUTO RADIOS

RECORD SMASHING VALUES!



1949-1950-1951
CUSTOM-BUILT AUTO RADIOS
LIST PRICE—$59.95

Ford, Chevrolet, Plymouth, Dodge, Henry J, Hudson, Studebaker. Each radio is a six tube superheterodyne six volt battery operation—three gang tuning condenser and tuned RF stage PM speaker Alnico No. 5., wt. 10 lbs.—easy installation.

ATTRACTIVE DISCOUNTS TO DEALERS

SPECIAL



Navy entering type insulator. Porcelain flanged bow with brass rod and fittings and aluminum shield. Dimensions 4⅝" high, 6-5/16" O.D. at base. NEW with Spare Bowl ... $4.90

TUBES Prices Slashed

2C34	$2.85	6AL5	.69
2X2/879	.69	6AQ5	.79
3C24	1.95	6AR8	.79
7C4/1203A	.95	6AS5	.99
10Y	.85	6AU6	.69
15R	.85	6AU8	.99
30 SPEC	.59	6BA6	.79
30-34	.60	6BA8	.69
45 SPEC	.95	6BE6	.73
WE 205A	6.80	6BJ6	.99
801A	4.95	6BQ6GT	1.19
W1531	4.95	6BZ6GT	.63
713A	1.00	6J6	1.29
801A	4.95	6K6	.79
803	6.45	6L7	.98
826	.95	6M7GT	.68
931A	4.95	6N7GT	.79
954	.69	6SA7	.79
CK1005	.65	6V6GT	.68
CK1007	1.20	6W4GT	.64
1616	.65	6X4	.79
1629	.35	6X5GT	.79
2051	1.19	7A6	.69
7193	.50	7Z4	.69
8013	1.75	12AU6	.79
8014	1.75	12AT6	.79
9006	.39	12AV6	.73
CSB	9.75	12AV6	.73
CRQT2	1.30	12BA6	.79
CK76	4.25	12BE6	.69
CRP-72	1.30	12SQ7	.69
E-1148	.35	12SQ7	.85
HY-615	.25	25Z5	.75
HK/T2	1.20	35Y	.69
RK-73	.95	35W4	.59
5BP1	4.95	50B5	.99
5FP7	1.95	50L6	.79
14G	.75	50C5	.69
1B3GT	.85	50L6GT	.69
5U4G	.57	75	1.19
5W4	.90	85	.85

RELAYS

12VDC	DPST Allied Box 32	$1.25
24VDC	SPDT 5 amp	1.50
24VDC	DPST Allied DJG106	1.45
24VDC	Solenoid operates 2 switchettes	1.75
40VDC	DPST 1000 OHM	1.25
110VAC	DPST 1 amp contacts 90¢ the Dozen CXA-1976	3.95
110VAC	DPDT 25 AM contacts Ward Leonard	3.00
115VAC	DPST 60¢ the Dozen CXA-2097	3.95
220VDC	DPDT 60¢ the Dozen CX-2122	4.90

HI-VOLTAGE FILTER CHOKES

.4 HY 4.5 Amp DC 3 Ohms RMS to ground GE 6D6131-1	1230	NEW
1.7 HY 1 Amp DC 9000VDC GE Y34648		NEW
.25 HY 4 Amp .5 Ohm 20,000 Test		NEW
1 HY 5.2 Amp DC 2.5 Ohm GE 6D6459		NEW

PRICES ON REQUEST

MICROWAVE EQUIPMENT

- 10CM Band X Band Frequency Range 2800MC-3175MC Direct Reading Wavemeter Head Ring Precision Scale Plus 9% to Minus 9%. Type "N" Input. Resonance Indicator Meter with Accessories and 10CM Directional Coupler and Spares—Brand New. $9.50
- 90 Radar 10CM Rotating Antenna 24" Parabola in Turret 360 Scan—Brand New. $9.95

PRICES UPON REQUEST

All Sizes of Crystal Electrodes.

LINEAR POTENTIOMETERS WW

Ohms	Watts	Ea.	Ten
500	2	$0.45	$0.40
1000	2	.50	.45
2000	2	.55	.50
10,000	2	.55	.50
5000	3	.50	.45
7500 Dual	3	.55	.50
10,000	3	.55	.50
25,000	3	.65	.60
50,000	4	.85	.75
15	25	.95	.90
20	25	.95	.90
25	25	.95	.90
50	25	.95	.90
100	25	.95	.90
200	25	1.70	1.50
500	25	1.70	1.50
1000	25	1.70	1.25
3000	25	1.40	1.25
5000	25	1.40	1.25
15,000	25	1.75	1.60
20,000	25	2.00	1.95
150 Switch	50 AR 3155-50	2.15	2.00
700 W Switch	50	2.15	2.00
600	50	2.45	2.50
10,000	50	2.95	2.75
15	50	2.95	2.75
15	75	2.95	2.75

TIME DELAY SWITCHES

1 Minute 115V AC 4 Sec. Inst. in Waterproof Metal Case. New $5.25

3 Micro Switches Make Contact at 40-41-42 Sec. Time Delay 115 VAC Motor 4.50

Thermo Switch 50° to 300° F. 115 VAC @ 8A, 230 VAC @ 5A Breaks Contact with Increase of Temperature. New 1.25

30-40 Second Mercury Time Delay Relay 110 VAC Adjustable New 7.50

SPECIALS

80-80KC Crystal with Holder $2.50
CD-501A Cord for DC-934 to GN-45 1.95
Balloon with Hydrogen Gen. 2.50
300-FL Aerial Wire 2.50
Box Kite 17"x17"x36" 2.25
33-440 MMF Variable Condenser 1.10
T-100 MMF Variable Condenser .95
24-750 MMF Tapered Rotor Plates 1.25

CAPACITORS

TRANSMITTING MICA

.001 MFD	2500 WVDC		.50
.0004 MFD	2500 WVDC		.60
.0005 MFD	2500 WVDC		.70
.0030 MFD	2500 WVDC		.75
.005 MFD	2500 WVDC		.95
.00075 MFD	3000 WVDC		.75
.000075 MFD	3000 WVDC		1.30
.0002 MFD	3000 WVDC		1.50
.0003 MFD	3000 WVDC		2.65
.0002 MFD	5000 WVDC		2.95
.001 MFD	5000 WVDC		3.25
.001 MFD	6000 WVDC		3.75
.0002 MFD	10,000 WVDC		9.95

UPRIGHT MOUNT

		EA.	TEN
.25 MFD	600 VDC	.45	.40
2X.1 MFD	600 VDC	.45	.40
.1 MFD	600 VDC	.45	.40
1 MFD	600 VDC	.50	.45

BATH TUB

4 MFD	330 VDC	.45	.40
4 MFD	100 VDC	.55	.50
2X.1 MFD	400 VDC	.60	.50
2 MFD	400 VDC	.60	.50
4 MFD	400 VDC	.60	.50
5 MFD	600 VDC	.60	.55
2X1 MFD	600 VDC	.55	.50
2 MFD	600 VDC	.55	.50
2X.1 MFD	1000 VDC	.65	.60
1 MFD	1000 VDC	.65	.60

OIL-FILLED AND GE PYRANOL

1 MFD	600 VDC	.80	.80
2 MFD	600 VDC	1.40	1.40
4 MFD	600 VDC	1.40	1.40
1.5 MFD	600 VDC	1.40	1.40
1.5 MFD	600 VDC	2.50	2.35
4 MFD	1000 VDC	1.60	1.60
2 MFD	2000 VDC	2.00	1.90
.25 MFD	2000 VDC	2.05	2.00
.1 MFD	7500 VDC	12.50	12.00
1 MFD	7500 VDC	12.50	12.00
.15 MFD	12000 VDC	14.95	14.00
.0005MFD	15000 VDC	12.90	11.75
.045 MFD	10000 VDC	12.95	12.50

PAPER

8-8 MFD	600 VDC	2.20	2.15
	Tube, Filtermite		
8X8 MFD	600 VDC	2.55	2.40
8-8-4 MFD	600 VDC	2.45	2.25

ELECTROLYTIC

2500 MFD	15 VDC	.60	.60
500 MFD	15 VDC	.40	.35
25 MFD	25 VDC	.40	.35
40 MFD	25 VDC	.60	.55
50 MFD	50 VDC	.60	.55
1000 MFD	25 VDC	1.25	1.15
150 MFD	150 VDC	1.50	1.35
160-160MFD	150 VDC	1.50	1.25

TOGGLE-ROTARY SWITCHES

Pole	Posi-tion	Sec-tion	Shaft	Price
1	3	2	15/16"	$0.35
1	4	2	1.5/8"	.80
1	5	6	1.5/8"	.60
1	3	6	1.5/8"	.60
*2	4	2	2"	.75
*2	6	3	2.1/2"	.99
*2	6	2	3/16 DIA Flash Over	
*Ceramic				
DPST 3A 250 Volt W/Hardware				.99
DPDT Center OFF				.75
Momentary 2A 125VAC				1.15
3PDT 10A 277VAC				2.95
DPDT 5A 250VAC				1.30
DPST C-H AN3025-2				.90

TERMS: Minimum order $5.00—Mail orders promptly filled—All prices F.O.B. Boston, Mass. Send M.O. or check. Shipping charges sent C.O.D. 25% deposit required with all C.O.D. orders.

Prices Subject to Change without Notice
SEND FOR OUR CATALOGUE
Inquiries from Dealers, Schools and Industrial Firms Invited

COMET ELECTRONIC SALES CO.
22 Washington St. • HAncock 2-7863 • Brighton 35, Mass.



MAKE THIS YOUR HOME FOR IMPORTANT WORK UNDER IDEAL CONDITIONS!

- TEST & INSPECTION ENGINEERS
- FIELD ENGINEERS
- ELECTRONIC ENGINEERS
- LAB. TECHNICIANS
- TV RECEIVER DESIGN ENGINEERS

NEEDED TO WORK ON Radar, G. C. A., Mobile Radio, Auto Radio, Airborne Communication & Navigation Equipment, Television, Antennas, Microwave Equipment, Servo Mechanisms and Guided Missiles.

YOU BENEFIT FROM high wages, a modern, air-conditioned plant, paid vacations and holidays, group insurance and a good chance for advancement.

Housing immediately available in the beautiful suburban and country areas that surround the Bendix Radio plant.

Write, Phone or Wire Mr. E. O. COLE, Dept. O

Bendix Radio
DIVISION OF BENDIX AVIATION CORPORATION
BALTIMORE 4, MARYLAND

NOW! BECOME EXPERT AT

RADIO-TELEVISION

IN 4 EASY STEPS!



Complete Self-Training Course in RADIO and TV by Famous Experts — Takes You BY SIMPLE STEPS From Basic Theory to Problems of Repair, Installation, Color TV, etc.

NOW you can do ANY Radio-TV installation, service, or repair job like an expert, operate field-testing equipment, understand problems of TV, FM-AM transmission, etc. Step into a good-paying job or start your own service business. Train yourself AT HOME — IN SPARE TIME — with the McGraw-Hill Basic Course in Radio and TV.

2296 Pages—1611 Illustrations

The men who wrote this complete 4-volume course are among the outstanding radio and TV instructors in America today. Every detail is clearly explained in over TWO THOUSAND PAGES of step-by-step instruction and over SIXTEEN HUNDRED "how-to-do-it" illustrations, cross-section diagrams, etc. The review questions and answers "nail down" everything you learn. At a glance "trouble-shooting" charts show how to diagnose instantly any radio or TV breakdown — and how to repair it expertly and quickly.

The course will pay for itself many times over. If you qualify as beginner for FCC 1st Class License test, gives an experienced technician more confidence and skill.

SEND NO MONEY

Mail coupon below to examine complete four-volume course FREE for 10 days. No obligation. Or you may examine individual books FREE for 10 days by checking the proper boxes in coupon.

PARTIAL CONTENTS

ESSENTIALS OF RADIO. 800 pages. 413 illus. Circuit Analysis • Vacuum Tubes • Amplifier • Detector • Audio • Tube Oscillator • Power Supply • Transmitting • Receiving • TRF.

ELEMENTS OF RADIO SERVICING. 475 pages. 325 illus. Multimeters • AC Power Supply • Speakers • Antennas • Auto Radios • Push-Pull Output Stage.

BASIC TELEVISION. 592 pages. 413 illus. Scanning • Synchronizing • Video Signal • Brightness Control • DC Restoration • Picture Tube • FM Alignment • Picture Tubes • VHF and UHF transmission • Reception.

TELEVISION SERVICING. 429 pages. 388 illus. Antennas • Transmission Lines • Test pattern and Picture Analysis • Localizing Reception Troubles • Interference Remedies • Deflection Circuits • AND MUCH MORE!

FREE 10-DAY TRIAL COUPON

McGRAW-HILL BOOK CO., Inc., Dept. RTN-3-52
327 West 41st St., New York 18, N. Y.

Send me for 10 day free examination the Basic Course in Radio and TV. 4 Vols. (Regular retail price is $26.00. Special Course Price only $21.95 in easy installments.) If not satisfied with Course, I will return it, pay nothing. Otherwise, I'll send $1.95 plus delivery then and only $4.00 in monthly installments.

If you wish to examine any of these books individually, check below the ones you wish us to send you for 10 Days' FREE EXAMINATION.

☐ Essentials of Radio, $6.75 ☐ Elements of Radio Servicing, $5.25
☐ Basic Television, $7.50 ☐ Television Servicing, $6.50

For any book I keep, I'll send $2.00 plus delivery in 10 days, balance in easy monthly installments.

Name .....
Address .....
City ..... Zone ..... State .....
Position .....
RTN-3-52
Company .....

WE PAY FOR DELIVERY if you send first payment of $1.95 when ordering Course or full price when ordering individual books (prices above). Same return privilege.

noted to 1845 sign-off. (Saylor, Va.) Usually has bad QRM; some days is buried completely.

Madagascar—Radio Tananarive, 9.515, noted from around 1100 to after 1230; uses French. (Pearce, England) *GDX-aren*, Sweden, says this one signs off 1430.

Mauritius—Forest Side, 15.100A, now has its "morning" session 2200-2315. (Ridgeway, South Africa, via Radio Australia)

Mexico—XEQQ, 9.68, noted in South Africa from 2230-0000; at 2300 gives call preceded by 4 chimes. (Ridgeway)

Monaco—Radio Monte Carlo, 6.035, 9.785, noted on Fridays around 1745 with "Back to the Bible" program in *English*. (Pearce, England) This feature ends around 1800 and station usually signs off (Fridays) 1803. (Boice, Conn., others)

Mozambique—Lourenco Marques, 9.720A, is widely reported afternoons in *English* to 1600A sign-off, good signal in most areas of USA. (Dalton, W. Va.; Stark, Texas; Bellington, N. Y., others) Heard with Portuguese programs from 0000 on 9.850A. (Sutton, Ohio; Niblack, Ind., others) Catch, England, says CR7BV has again moved to 4.830 where is noted with chimes and call 1215 after giving African news in Portuguese; fair level; CR7BG, 15.283, noted 1220 in parallel with CR7BV with all-Portuguese program; popular recordings (mainly *English*) until *after* 1330. Bellington, N. Y., reports Lourenco Marques heard recently on 15.27 from 1310 tune-in to 1500 when closed with "A Portuguesa;" all-Portuguese session. Pearce, England, says Lourenco Marques is heard on 15.275A at 1200 with news in Portuguese, chimes; call at 1210; he also notes Lourenco Marques on 4.925A at 1245.

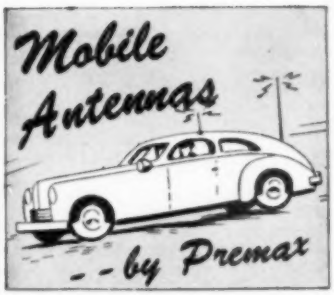
New Caledonia—Radio Noumea, 6.034A, is coming through at nice level around 0330-0530A sign-off. (Saylor, Va.)

New Zealand—ZL2, 9.54, and ZL3, 11.78, noted 0250. (Pearce, England) ZL4, 15.280, heard 2135 recently with cricket results; signal still good 2205. (Ferguson, N. C.)

Nicaragua—YNZZ, 6.464, Managua, *Radio Mundial*, noted 2112-2146 with moderate QRM from COCY, 6.450, Havana, Cuba; all-Spanish; YNHB, 6.550, Managua, *Radio Panamericana*, heard 2208-2245. (Patterson, Ga.) YNVP, 6.760, Managua, heard 1900-2245 with music and speech in Spanish. (URDXC) A station on *measured* 7.8489 has been identified as Managua; may be YNSO, *listed* 7.860; noted 1946. (Oskay, N. J.)

Nigeria—Radio Nigeria, 7.255, Lagos, noted with interval tune around 2329 prior to 2330 sign-on. (Bellington, N. Y.)

Northern Rhodesia—ZQP, Lusaka, transmits on Sundays a "morning" program on 9.710 at 0300; announcements are in *English* with native recordings and BBC-transcribed programs; has South African news 0500 followed by talk in *English;* closes 0545 after playing "God Save the King;" broadcasts



From 2 to 75 Meters

Tested and proven Antennas for the 1¼, 2, 6, 10, 11, up to 75-meter mobile installations —designed to increase the signal strength and yet offer low-cost equipment for amateurs and Civil Defense Corps.

Send for special Bulletin and prices.

PREMAX PRODUCTS
DIVISION CHISHOLM-RYDER CO., INC.
5205 Highland Ave., Niagara Falls, N. Y.

Brooks LIFE-SIZE Edition
#630 TV KIT BUILDER • SET OF INSTRUCTIONS

Instructions ..... by WALTER H. BUCHSBAUM
Layouts and Artwork ..... by GEORGE MILLER
Practical Applications . by IGNAZIO MERCANTE
Compiled and Edited .. by MORRIS BROOKS

Everything at a glance on 4—GIANT 25" x 38" Charts

INDISPENSABLE—for building, converting, modernizing or even trouble shooting any #630 TV RECEIVER.

Popular priced at only **$2.49** Plus postage. Brd cities ...30c or mail ...72c

BROOKS, 84 Vesey St., N. Y. 7, N. Y.

Unlimited Opportunities in
RADIO ENGINEERING
DEGREE IN 27 MONTHS

Complete Radio Engineering course, including Telev., U.H.F. and F.M. Bachelor of Science Degree, also in Mech., Civil, Elect., Chem., and Aero. Eng.; Bus. Admin., Acct. Extensive campus, modern buildings, well equipped labs. Low cost. Prep courses. Personalized, practical instruction. Founded 1884. Placement service. Growing shortage of engineers. Prepare now for unlimited opportunities ahead. **Enter September, January, March, June. Write for catalog.**



TRI-STATE COLLEGE
1632 College Ave. ANGOLA, INDIANA

daily on 7.220 and 3.914 at 0900-1230. (Ridgeway, South Africa, via Radio Australia)

Norway—Oslo, 11.735, noted signing off 2100 in Norwegian and *English*. (Stein, Calif.)

Pakistan—Radio Pakistan, 6.234, is heard at high level in South Africa 1130 in foreign language; closes 1200 after identification. The 1210-1230 news at dictation speed is now noted on 9.478A. (Ridgeway, South Africa) Noted 1015 with news on 11.675. (Sutton, Ohio) And in parallel then on 4.805. (Pearce, England)

Panama—HOLA, 9.505, Colon, heard with *English* request program 2118-2136. (Machwart, Mich.) HP5B, 6.030, Panama City, heard opening 0615 with announcement in Spanish that is relaying HOX, *Radio Mirimar*, P.O. Box No. 124. (Ferguson, N. C.)

Paraguay—Radio Nacional de Paraguay, 6.270, Asuncion, goes off the air just *after* 2200; has local clock striking 11 p.m., then identifies as ZP1 and ZPA1. (Stark, Texas) ZPA3, 11.850, noted 1900-1945. (Sutton, Ohio)

Peru—OAX1A, 6.155, *Radio Delcar*, Chiclayo, noted to 2330 sign-off. (Stark, Texas) OAX4Z, 5.887, Lima, *Radio Nacional del Peru*, heard 1915-1930; all-Spanish; QRM. (Patterson, Ga.) OAX4W, 9.4045V, Lima, noted 2205 with weak signal; had news in Spanish. (Oskay, N. J.) OAX4Z, *Radio El Sol, listed* 15.105, is heard 2300-0100 some days but appears to be on approximately 15.112. (Ridgeway, South Africa)

Philippines—When this was compiled, *WRH Bulletin* reported that the short-wave transmitter of "The Voice of Davao," Davao City, Mindanao, DXH2, 7.280, was off the air, and that the station was broadcasting only on m.w. 900 kc. with call DXMC.

The Far East Broadcasting Co., Manila, now uses 3.320, 6.030, 9.730, 11.855, and 15.300 with *English* weekdays 0000-0100, 0300-0515, 0700-0900, 1830-2030, Sundays 0030-0530, 0630-1100, 1800-2330. (Radio Sweden)

Poland—Warsaw noted on 6.115 at 2314 with interval signal, music, then start of *English* session. (Machwart, Mich.) Current schedule for *English* broadcasts to North America is 1700, 1730, 2315, and 0030 on 6.115. Asks for reports and comments to Polskie Radio, English Language Transmissions to North America, Aleja Stalina 21, Warsaw, Poland.

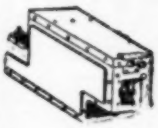
Portugal—Leary, Ind., reports Lisbon on 15.125 to 0945 sign-off. Noted by Niblack, Ind., to 1530 closedown on 11.996A, usually excellent volume.

Lisbon noted on 15.130 signing off 1130 with "A Portuguesa" after clock chimes; heard another day signing on with "A Portuguesa" 0915; noted 1700 on 11.96A and leaving the air 1800 with "A Portuguesa," parallel with 9.740; noted on 11.99 at 1445 with a broadcast in Portuguese for Angola-Mozambique and signing off on that channel with "A Portuguesa" at 1530, in parallel with 9.740. (Pearce, England)

Radio Free Europe, 6.095, heard with

Sam's Surplus Sells For Less

COMMAND AND/OR ARCS TRANSMITTERS and RECEIVERS



3-6 MC Receiver. Used $ 6.95 New 17.95
6-9.1 Receiver. Used $ 6.95 New 12.95
Triple Receiver Rack $1.95
V.H.F. ARCS Transmitter or Receiver, Complete w/tubes Used $24.95

	Used	New
2.1-3 MC Transmitter with tubes	14.95	
4-5.3 MC Transmitter with tubes	6.95	
5.3-7 MC Transmitter with tubes	6.95	
7-9.1 MC Transmitter with tubes	9.95	$19.95
3-4 MC Transmitter with tubes	18.95	
28V Receiver Command Dynamotors	$0.97	

MODULATORS

BC-456 with Tubes, less dyn.	2.95
MD-7/ARCS Plate Modulator	8.95
MD-7 Modulator Dynamotor, 28V	2.95
BC-433 Receiver—with tubes	$24.95
MN-26C Compass Receiver	24.95 $39.50
MN-26Y Compass Receiver	24.95 39.50
BC-357 Marker Beacon Rec. W.O. Tube	5.95



BC-223 **Transmitter**. 30 watt. Ideal for Ship-to-Shore or Ham Rig. Crystal or MO control on four pre-selected channels. 2000 to 5250 KC. Use of 3 plug-in coils. Five tubes: 2—801, and 3—36, and TU 17—18—25 tuning units.
Transmitter—$39.95. Tubes—$.75. Tuning Units—$2.25. Amp Meter. No. 60-0-60. New—1.29.

CIVIL AIR DEFENSE or 2 METERS

ARC-4. W/tubes. Good, used	$29.95
522 Trans.-Receiver. W/tubes. Good, used	69.50
Modulation Transformer. BC-375. New	2.49
BC-375 Trans. 100 Watt Voice, CW, MCW, freq. range 200 kc to 12 mc, uses Plug-in Tuning Units listed complete with tubes, less Tuning Units	$29.95
Tuning Units for BC-375 or 191 Trans:	
TU- 7 4500- 6200 kc	$2.49
TU- 8 6200- 7700 kc	2.49
TU- 9 7700-10000	2.49
TU- 10 10000-12500	2.49
TU- 22 & TU-26 200-500 kc each	4.50
FT-151 Shock Mounting for BC-375 or 191	2.95
BC-306 Antenna Loading	1.95
GP-7 Navy Transmitter: 100 watt master os. Can use on any freq. from 350-9050 kc. by using proper plug-in. With 1 tuning unit	$13.33

LOOP ANTENNAS



DU-1 2 tube amplifier.	New	$25.95
MM-20-E	New	7.95
LP-21 A	New	16.95
Rotatable Loop Unit—Type MN-20E. 8" diameter—used with MN-26 Compass and RA 10 DB. By Bendix. Only		$7.95
FL8 Filters—A's, B's, C's	New	1.95
FL5 Filters	New	.95
Hand Keys—J-38	New	1.19

TBC Transmitter & Receiver with 12V Power Supply and Cables. Good—used $179.50
Heineman Circuit Breakers 115 V., 20 amp. 1.39
115 V., 5 amp. .97
Prop. Pitch Transformer, only new 6.95
RT-7PN-1 Transceiver w/o tubes. Used 9.95

"S" METER

"S" METER — SAM'S SPECIAL. Illuminated face (supplied with miniature lamp). Full scale reading of 5 ma. A standard value for most "S" Meter Circuits. Dia. across face — 2½". Black bakelite face. Reverse-set pointer New $2.49
Vibrators—Mallory. For use on 12 V battery New $0.97

TRANSFORMERS

12V 24V 2am 110V primary	$2.95
ARC-4 2 Meter Transceiver tubes, good, used	$29.95
BC-434 Control Used—$1.95 New	2.95
Code Tapes for TG-10 15 rolls. New	7.95
BC-906 Absorption Type Freq. Meter Range 150-225 mc. 0.500 DC Microm. Used	$11.50
Field Phones E-E 8's Used	$19.95 pr.
	New $34.50 pr.
Relay, SP-ST, Leach 6 V or 12 V New	1.49

CRYSTALS—CR IA/AR

8150.000—8036.25—8001.43 $1.19 ea. 3 for $2.95

DYNAMOTORS



PE103 **New Case** $29.95
PE-103 **New,** Less Base 19.95
DM-32A Input 28V. Output 250 DC, .06 amps. Used 1.95
PE-73 29V @ 20 amps. output 1000V @ .350 amps. New 8.95
PE-77 14V @ 40 amps output 1000V @ .350 amps New 19.95
SPEC. 27V @ 400V 7.50 mil 750V 350 mil New 12.95
PE-94 Dynamotor only 4.95
PE-96 or SCR—522 24V. Used—$5.95 New 14.95
DM-34 12V @ 2.8 amps. Output 220V @ 160 amps New 9.95
SPEC. 9V @ 450V output @ 80 ma. New 5.95
SPEC. 12V @ 320V output @ 80 ma. New 4.95
SPEC. 6V @ 250V output @ 80 ma. New 4.95
SPEC. 12V @ 440V output @ 200 ma. New 12.95
ARC-1 DY-9/ARC-1 Used 11.50
14 Volt Input—425 Volt Output at 163 mils. Starting Filter and Relays in base. Like New 3.95
RL-42B Antenna Reel Ass. Less wire. New 9.95

OIL CONDENSERS



Standard Makes—New		
2 mfd	600V	$0.49
4 mfd	600V	1.39
1 mfd	1000V	.69
3 mfd	4000V	7.95
.5 mfd	2500V	1.49
10 mfd	600V	7.95
2 mfd	2500V	3.95
2 mfd 5000V	$ 8.95 2 mfd 7500V	29.50

T-30 Throat Mikes Used—3 for $0.50
CD-307 Head Set Extension Cord 1.19

HEAD SETS



HS-30	New	$1.95
HS-23	Used—$1.95; New	2.95
Matching Transformer for HS-30		.69
BC-348 Mounting Base		2.49
RG-7U Coax Cable, 97.5 ohms	foot	.08
MIKE CHEST SET "T-1" button	New	2.95

DECK INSULATORS



Bowl & Flange type. Heavy galv. metal flange—10½" dia. Porc. bowl set in rubber gaskets. Top bell—7¾" dia. Brass feed thru rod L insul. dist. between top bell and flange—6½". New $2.95

Cash with order. Prices subject to change without notice. California orders please include 3½% Sales Tax. Please include approximate postage—Excess will be refunded. What Have You in Surplus? Submit

ESEGE SALES COMPANY INC. 1286 BOND STREET, at PICO LOS ANGELES 15, CALIFORNIA

RMC TRANSCRIPTION PLAYER



16" Synchronous
Model TP16F $126.00
Model TP16D $84.00
Model TP12H $58.50
(F.O.B. Port Chester, N. Y.)

Export: Rocke International Corporation.
13 East 40th Street New York 16, N. Y.

FOR HIGH FIDELITY RECORD REPRODUCTION

Meets the rigid demands of Army-Navy requirements, even Navy salt-spray test. Used by U. S. Signal Corps all around the world. Standard equipment in Veterans' Hospitals, and most radio stations, transcription services, etc., for realistic reproduction of transcription records up to 16 inches, 78 and 33⅓ r.p.m.

Descriptive Bulletin HS3-1, upon request.

Available Through Authorized Jobbers.

RADIO-MUSIC CORPORATION
PORT CHESTER • NEW YORK



AUDELS TV SERVICE
TELLS HOW TO SOLVE TV TROUBLES AND ANSWERS TV QUESTIONS

AUDELS TELEVISION SERVICE MANUAL covers T.V. information at your finger ends. Shows good receiver adjustment and How to Get Sharp, Clear Pictures, How to Install Aerials—Avoid Blurs, Smears, Interference and How to Test, Explains Color Systems and Methods of Conversion. IT PAYS TO KNOW! Over 380 PAGES & 225 ILLUSTRATIONS explaining operating principles of Modern Television Receivers.

Just Out!



1001 FACTS
19 CHAPTERS

Placement of Television Receivers—Receiver Controls, Test Patterns & Adjustments—Television Interference—Interference Traps—Television Antennas & Transmission Lines—Master Antenna Systems—Antenna Installation Procedure—Television Broadcasting—Television Receiver Fundamentals—Circuit Description of Typical Receiver—Television Picture Tubes—Projection Type Receivers—Television Testing Instruments—Television Servicing—Trouble Shooting—Color Television—Television Terms.

$2 POST PAID

7 DAYS FREE TRIAL
GET THIS PRACTICAL ASSISTANCE FOR YOURSELF
MAIL COUPON TODAY

AUDEL, Publishers, 49 W. 23rd St., N.Y.
Mail me postpaid for 7 Days examination AUDELS TELEVISION SERVICE MANUAL Price $2. If O.K. I will mail you $2, otherwise I will return book.

Name .....
Address .....
Employed by .....
TV 3

BUY WITH CONFIDENCE
5 DAY MONEY BACK GUARANTEE
ELECTRONIC SURPLUS MATERIALS

RELAY SPECIALS

Type	Coil	Contacts	Features	PRICE
Sigma 4F	8000	SPDT	1 ma plate	$2.95
Sigma 5	55 (2)	SPDT	2-24 VDC	2.45
Leach 1077BF	150	DPDT	ANTENNA TYPE	2.45
Clare Type C	400	DPST	makes 11V	1.25
Clare Type C	3500	DPDT	8 ma plate	1.85
Allied F10	42	SPNO	6 VDC MINI	.75
Allied B9	200	4PDT	10 AMP CONT.	3.25
Allied B0	14	4PDT	6 VDC 10 A CONT.	2.35
Rotary Relay, 14 v operation, remote model trains, etc.				2.45
Kinax Type ER Thermal Relay, 110 220VAC				1.35
1 RPM 110 V 60 cy Instrument Motor, 96 Gear Ratio				1.85
G.E. Thyrite unit, neg. 3rd harmon. generator, 5.40 ma @ 23 R volts, pkg of 2				1.45

OIL CAPACITORS

2 MFD, 600 W VDC oil, sealed, hermetic, new	$0.95
4 MFD 600 VDC with mtg. lugs	1.35
4 MFD 1000 VDC upright with spade bolt tabs	1.65
6 MFD 600 VDC upright with spade bolt tabs	2.95
10 MFD 600 VDC upright with spade bolt tabs	4.75
2 MFD 1000 VDC upright with mtg. tabs	1.65
4 MFD 1000 VDC upright with mtg. tabs	2.35
1 MFD 1500 VDC upright with mtg. tabs	1.65
2 MFD 1500 VDC upright with mtg. tabs	6.25

MANY OTHER VALUES & TYPES STOCKED. ORDER WITH US FOR PRICES, ETC.

LIP MIKES, ARMY CAC	$1.00
THROAT MIKES, ARMY, T-30V	.95
CARRIER CURRENT REC. 115, 230ke set of 3	1.75
HAND DRIVE GENERATOR, portable rigs 6V, 12V & 115V, 200 ma	6.95
110 VAC sounder buzzer	.79
MOBILE G.E. ROOFTOP ANTENNA	3.75

ELECTRONIC SPECIALTY SUPPLY CO.
56-8 Lispenard Street New York 13, N. Y.

KAAR
RADIOPAK
THE MOBILE RADIOTELEPHONE
KAAR ENGINEERING CO.
PALO ALTO - CALIFORNIA

Eastern European languages 0155 tune-in; leaves the air 0203-0205 and has no signature tune then; also heard 1500 and still on the air 1805. (Pearce, England)

Portuguese China—Serrano, Brazil, airmails that he has definitely confirmed that a short-wave station called *Radio Vila Verde* is now operating from Macau, probably around 9.500. He hopes to have further data on this one soon.

Sao Tome—The 17.6775 channel noted a recent Sunday with light recordings 0750, program details in Portuguese with guitar musical background 0800, and closing 0803 with "A Portuguesa." (Pearce, England) Also heard in North Carolina. (Ferguson)

Saudi-Arabia—Djeddah, 5.975, noted signing on 2306 recently, in the clear. (Bellington, N. Y.) This one heard in Virginia in Arabic 0300-0400 sign-off. (Saylor)

Sierra Leone—GDX-aren, Sweden, says Freetown has an *experimental* station of 0.3 kw. sending on 9.630; noted with BBC's General Overseas Service from London to 1700 sign-off. *Not confirmed.*—KRB.

South Africa—SABC's African Service noted from Johannesburg, 15.230, at 1000 with light music and opera; closed 1045; poor level and jamming QRM. (Catch, England) Heard in *English* 1130 on 11.937. (Pearce, England)

Southern Rhodesia—Salisbury, 3.320, noted closing 1500; has BBC news relay 1300; home news 1310; weather forecast, local, and South African news 1315. (Pearce, England)

Spain—Radio Nacional de Espana en Malaga, 7.01A, noted with call 1340. (Pearce, England) Cadiz, 7.200A, heard most days around 1700-1800; plays many North American dance and popular tunes with *English* lyrics from 1730. When this was compiled, *Radio S.E.U.*, Madrid, was still operating near 7.09; *Radio Tullent Murcia* near 7.105, and *Radio Merida* between them. (Pearce, England)

Spanish Morocco—*Radio Tetuan* heard recently on 6.063A at 1755 with program preview for next day; off 1800; heard another day as early as 1700. (Pearce, England)

Surinam—PZX5, 15.405, Paramaribo, noted recently with good level in Eastern-type musical program when tuned 1520; at 1531 had announcement followed by a VOA program. (Ferguson, N. C.)

Switzerland—United Nations Radio, 6.672, is heard daily 1330 with news in *English;* news in French 1345; leaves air 1400; has woman announcer. (Ridgeway, South Africa) Berne, 15.305, has fine level in *English* for India-Pakistan 0945.

Syria—Damascus, 11.913A, still noted to 1735 sign-off; asks for reports to SBS, English Section, Damascus, Syria. (Leary, Ind.) Last hour is in *English*.

Tahiti—Radio Tahiti, 6.135, Papeete, noted with news in French, music, around 0015; fair level in Calif. (Winch)

Taiwan—Radio Free China, BED3, 15.234, BED6, 11.735, Taipeh, has its North American transmission in *English* 2300-2400; opens with chorus singing and call by woman announcer. (ISWC, London) The 7.135A outlet noted with fair level around 0700-0800. (Stein, Calif.) Ferguson, N. C., recently checked 11.735 and 7.135A channels around 0630-0735 but found no *English* at any time during the check period; formerly had *English* 0630, 0700, or 0730.

Tangiers—Radio International noted on 6.110 at 1515 tune-in; news in French 1530; still on the air 1600. (Pearce, England) *Radio Africa*, 7.127A, noted to 1900. (Leary, Ind.)

Thailand—HS8PD, Bangkok, broadcasts Home Service programs in Thai 0700-1000 on 11.910. (WRH Bulletin)

Trinidad — Radio Trinidad, 9.625, noted with music 1745, BBC news relay 1800; poor signal in Missouri. (Newcomb) has bad QRM evenings; still signs off 2200. (Patterson, Ga.) Noted with news 0545 and identifying as "Radio Trinidad and the Radiodiffusion Golden Network." (Rosenauer, Calif.)

Trans-Jordan—Nattugglan, Sweden, reports Ramallah heard on 7.030 to 1421 sign-off with march.

Turkey—A station of the Physical Institution of Istanbul University is audible *irregularly* on 7.750 with Oriental and Western music. *Radio Ankara* now broadcasts in 14 languages in addition to Turkish. (Radio Sweden) TAV, 17.83, is heard with good level to Far East in *English* 0730-0815. (Ridgeway, South Africa) Noted with weak level in North Carolina. (Ferguson) TAT, 9.515, still heard at fine level in *English* to North America 1815-1900. (Van Gilder, Mass.) TAS, 7.285, heard in *English* for Western Europe 1600-1645. (Green, Ontario) TAP, 9.465, is scheduled in parallel.

Uruguay—Radio Carve, 6.157, Montevideo, noted 1930; QRM. (Stark, Texas)

USI (Indonesia)—YDQ, 9.552, Makassar, Celebes, heard at fair level 0900-1000 sign-off. (Ridgeway, South Africa) Jogjakarta, 7.098, noted with fair signal recently 0700-0830 fade-out; gave call of YDJ2. (Saylor, Va.) Djakarta, 6.045, noted around 0557 with popular American songs with *English* lyrics. (Bellington, N. Y.) The Djakarta station *Radio Andir* verified for its 7.165 outlet; transmitter is *RCA*, 7.5 kw., with beams on Northeast and West Java; schedule on 11.940 now is 0430-0630; verification cards will be issued from Djakarta shortly. (Cushen, N. Z.)

USSR—Short Wave News, London, says a Soviet station heard on 5.484 around 1450 is believed located at Molotov.

A *new* transmitter in Petrozavodsk has been heard on 4.950 with programs in Finnish and Russian. *(WRH Bulletin)* Khabarovsk, 9.378A, has Chinese program 2100-2200, weak level in Virginia. (Saylor) *Radio Moscow* is good signal 0800-0830 in *English* to

SEE LEO FIRST FOR....

hallicrafters

I can SAVE you money... Liberal Trade-ins





$169.50

New S-76 RECEIVER

Extra selectivity with double superheterodyne circuit. One RF, two conversion and 3 IF stages. Range 550-1550 Kc, 1.7-34 Mc in four bands. 8 tubes plus voltage regulator and rectifier. Complete with tubes, less speaker.

R-46 SPEAKER $19.95



$199.50

SX-71 RECEIVER

Double Conversion sharp selectivity, plus built-in NBFM at moderate cost. 11 tubes plus voltage regulator and rectifier. Low down payment.

R-46 Speaker $19.95

NAME YOUR TERMS • LOW DOWN PAYMENTS • PERSONALIZED SERVICE

HALLICRAFTERS RECEIVERS AVAILABLE FOR IMMEDIATE SHIPMENT

S-38B	$49.50	S-72 Portable	$109.95
S-40B	$99.95	SX-62	$289.50
S-81	$49.50	S-78A	$89.50
S-82	$49.50	S-76	$169.50
R-46 Speaker	$19.95		

Famous WRL RADIO REFERENCE MAP 25c



CU on 10-20 & 75 Meters

NEW LOG BOOK 25c

For mobile or fixed station. Spiral binding. Full column log listing all FCC required info. Will accommodate 1,525 stations. "Q" signals, phonetic alphabet, amateur international prefixes.



JUST OFF THE PRESS!

WRL 1952 CATALOG

Send for your copy today. Contains everything new in radio and television. Jam-packed with bargains. Leo I. Meyerson, WØGFQ



FREE

PHONE 7795 WRITE—WIRE

World Radio LABORATORIES INCORPORATED COUNCIL BLUFFS, IOWA

WORLD RADIO LABORATORIES R-3
744 West Broadway
Council Bluffs, Iowa

Please send me:

☐ Radio Map ☐ SR-75 Info
☐ New Catalog ☐ SX-71 Info
☐ Used Equipment List ☐ New Log Book

Name .....
Address .....
City ..... State .....

RADIO COURSES

- RADIO OPERATING • CODE
- RADIO SERVICING • ELECTRONICS
- F.M. TELEVISION
- PREPARATION FOR CIVILIAN, MARITIME, ARMY AND NAVY LICENSE REQUIREMENTS.

Write for Catalog T.S.

YMCA TRADE & TECH. SCHOOL 15 W 63 St N Y 23 ENdicott 2-8117

TV9

MARK THESE VALUES!

TOP STANDARD BRANDS ONLY—100% GUARANTEED

RCA—GE—SYLVANIA—HYTRON—PHILCO—KENRAD—NU-TUNGSOL—WESTINGHOUSE—WESTERN ELECTRIC

1B3GT	.89c	6AG5	.85c	5U4	.59c	6J6	.98c	12AT7	$1.05		
024	.9 .64	6AQ7	.91 .16	SELL US YOUR IDLE TUBES AND SURPLUS CASH WAITING—TOP PRICES PAID				12BH6	.9 .84	35Z5	.9 .64
1L4	.72	6AW6	1.48					12BN7	1.07	5CG8	1.09
1R5	.79	6AX5	1.37					12SA7	.79	5U8	.67
1S5	.78	6AL5	.55					12SK7	.72	957	.39
1X2A	.95	6AU6	.84	6BG6	$1.85	6J6	$ .98	65K7	$ .79	6W4	$ .65	12SQ7	.64	6SN7	.99
5V4G	1.09	6BA6	.87	6BQ6	1.35	6K6	.64	6SN7	.79	7F8	1.49	All Amer. Kit			53.23
5Y3	.46	6BC5	.78	6CB6	.78	6N7	.98	6SL7	.99	12AU7	.84	Prices subject to change.			
6AB4	.80	6BE6	.77	6CD6	2.35	6SJ7	.79	6Y6	1.09	12BA6	.77	25% Dep. Bal. COD, N.Y.C.			

Phone: TYrone 3-5151

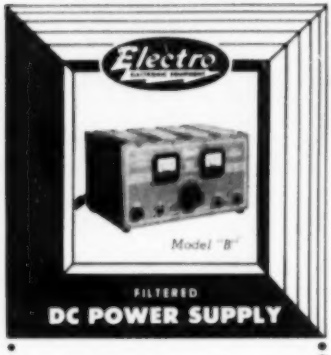
1000 Kc. CRYSTALS—Laboratory Precision Cut. New. Uncased. ..... Each 1.35

Write for Your Free Bargain List Now!

MARK electronics 1638 Randall Ave. New York 72, N. Y.

Services 2-Way Mobile Radios Best...

Say Manufacturers*



Leading Manufacturers Say . . . "It's the **only** one to withstand continuous high overloads, as we specify the Model "B" for servicing." Exclusive application of selenium rectifiers, aided by conduction cooling, doubles rectifier power rating, dissipates over 3 times the heat with lowest cost per ampere output. 1 to 20 amperes continuous duty with peak instantaneous rating of 35 amperes. Operates 2 auto radios with push-button solenoids simultaneously. **Net $49.80.**

Other Uses—Phone circuits, relays, instruments, low voltage devices, battery charging and electroplating.

* Names on request.

Model "BJ" Low-Cost Power Supply
6 Volts DC 1 to 12.5 Amperes
Net $37.50



Model "S"

CONVERTS BATTERY RADIOS TO AC ALL-ELECTRIC

Plugs into AC outlet. Hum-free reception from any 1½ volt 4-6 tube battery radio. Uses less than ¼ the power of cheapest AC radio. Fits battery space. Guaranteed 3 years.

Many Others Available



See Your Distributor! If He Can't Supply You, Write to Us!

FREE FOLDER!

ELECTRO PRODUCTS LABORATORIES
4501-Nb RAVENSWOOD AVE., CHICAGO 40, ILL.
In Canada: ATLAS RADIO CORP., LTD. • TORONTO

North America on 11.910, 11.960, 15.120. (Leary, Ind.) Noted in *English* 0430-0445 on 11.820, 11.630, 9.790. (Rosenhauer, Calif.) Best Moscow channels in Washington State for North American *(English)* transmission around 2000-2300 are 15.12A and 7.25A. (Oestreich)

Three Russian Home Service programs from Moscow are now on the air—First Program until 0830 on 9.720, 9.800, 11.765, 11.790, 11.880, 11.900, 11.905, 12.220, 15.170, 15.390, 15.440; from 0830 on 5.912, 5.955, 5.970, 5.980, 6.030, 7.175, 7.225, 7.260. Second Program until 0900 on 11.945; from 0915 on 7.115; from 1000 also on 6.130. Third Program until 1530 on 6.070. The news agency Tass uses these channels for its news service at dictation speed (in Russian)—5.780, 5.922, 5.940, 8.910, 9.145, 9.850, 12.020, 12.270, 15.040. *(WRH Bulletin)* Radio Tashkent, *measured* 6.8256, noted 2110 in foreign language. (Oskay, N. J.)

Vatican—HVJ broadcasts programs in *English* daily 1000 on 1529 kc., 9.646, 11.740, 15.120, and 1315 on 1529 kc., 5.968, 9.646, 11.740. (Radio Sweden) Has transmission for India each Tuesday 1030 over 11.740, 17.840. (ISWC, London) The 9.646 outlet noted 1345 beginning French session; in Italian 1430; heard dual on 5.97A at 1450 but at weaker level. (Bellington, N. Y.)

Venezuela—Radio Cabimas, YVMK (relaying YVML), is noted to *after* 2130, now on 3.410 (Stark, Texas) This one heard in Missouri at 1700 with fair signal. (Newcomb) YVKF, 4.880, Caracas, noted with news 1824-1830 when resumed in Spanish; announced *English* news for Mon.-Fri.; YVQA, 4.960, Cumana, noted 1907-1940, identification announcements by man included call of "Radio Sucre." (Machwart, Mich.) YVKT, *listed* 3.350, *Radio Libertador*, Caracas, goes *past* 2200 on Sundays; YVKX, 3.390, Caracas, is heard to *after* 2200; *Radio Tropical*, 3.400, Caracas, noted evenings; *Radio Maracaibo*, 3.440, runs to *after* 2130; *Radio Valencia*, 3.460, runs to *after* 2130 now. (Stark, Texas)

Yugoslavia — Belgrade, 6.100, has *English* 1145-1200 and 1400-1415; French 1415-1430, 1700-1715; appreciates reception reports and will verify if IRC is enclosed to Radio Yugoslavia, 6, Mose Pijade, Belgrade 2, Yugoslavia. (ISWC, London) Heard on this schedule. (Pearce, England)

* * *

Press Time Flashes

Radio Pakistan, 7.003A, Karachi, noted 1115 with news in native; high level; closes 1200. (Ridgeway, South Africa)

"Wir rufen den Osten! Wir rufen den Westen! . . . Sie horen den Kurzwellensender Freies Russland!" is the announcement in German of the *Free Russian Radio* said to be on the air in Russian and German daily 0730-0810 between 6.350-6.615. (Radio Sweden)

Ridgeway, South Africa, says *Radio A.E.F.*, French Equatorial Africa, uses *two* transmitters in parallel in its 1230 session (9.960 and 15.596); programs

SAVE MORE!

G.E. PYRANOL, 330 V., 60 Cyc., 1.75 MFD. $ 1.39
C.D. #173346 CAPACITOR, Paper, 250 MFD., 1.19
BC-927 B VOLTAGE REGULATOR, Good, Used. 7.95
BC-451 ADC 5 CONTROL BOX, Good. .89
BC-442 ADC 5 ANTENNA RELAY, less con-densers 1.89
BC-442 ADC 5 ANTENNA RELAY WITH CON-DENSER 2.79
BC-AE 406B CONTROL BOX 1.98
BC-AE 231 CONTROL BOX 1.49
BE-4881 CONTROL BOX 1.49
C-257 APQ7 CONTROL BOX 1.49
BC-453, less tubes, as is, clean 11.00
CD-307A CORDS with PL 55 and JK 26, ex-cellent .89
BC-375 W/Tubes and Tuning Unit, excellent condition 16.95
G.E. CIRCUIT BREAKER, 24 V., 200 amps., #CB 556-600, Brand New 1.95
LELAND VOLTAGE REGULATOR, Type "S-1," Input 105-130 V., 1 amp., 50 cy., Brand New 2.25
FLAT HEAD WOOD SCREWS, #12x2", Per Gro. .65
MORNING STICKS .05
CONTROL BOX C-260A AND-1A 4.95
BF-9 UPT MODULATOR ADAPTER 11.00
G.E. 78 R.P.M. PHONOGRAPH MOTOR AND TURNTABLE, Brand New 2.95
TRIMM HEADSETS, Like New. Per Pair 1.95
HS-33 HEADSETS, W/Plug and Cord, used, in good Per Pair 1.95
T-20-S MICROPHONES, W/JK 48A, Brand New. .79
T-30 MICROPHONES, W/PL 291, Excellent .29
#30 STEEL BARE WIRE, 12 to 15 lbs., per coil Per Lb. .18
WL 130 C WIRE, approx. 3,000 feet per can, Per Can 6.95
BC-1193 INDICATOR with CRT Tube and Cables 8.95
BE-73 SWITCH BOX, Brand New 15.00
AS-66 APT ANTENNA ASSEMBLY, Brand New. 6.95

GRAB BAG!!
Parts taken from equipment. Consists of High Voltage Transformers, Oil Filled Capacitors, Switches, Re-sistors, Terminal Boards, Sockets, Knobs, Relays, Con-trols, Coils, etc., etc.
WE LEAVE THE QUANTITY UP TO YOU!!!
ONLY **17c** PER POUND — THERE'S NO BETTER BUY ANYWHERE

DYNAMOTORS
Good—Used—Tested!

DM-18	$ 4.50	PE-119A	$17.95
DM-20	4.50	PE-117 A	15.95
DM-32	2.95	PE-117 A	29.00
DM-33	3.95	D-104, Dual 12 V.	
PE-73	4.95	Input, Output 225	
PE-94	3.45	and 440 V., Brand	
PE-218 INVERTER	11.95	New	19.95

80 BY-PASS CONDENSERS, TUBULARS, Paper, Wax Sizes .001 to .01 Mfd. Wkg. Volts ONLY $2.95
HOOK UP WIRE ASSORTMENT, Cut Lengths to 12", Stripped Ends. 2 Lbs. .99

POTENTIOMETER KIT
15 Types—Carbon and W.W., S.D. and Shaft Types. Includes 1g and 1 meg. W/Switches $2.65

RESISTOR KITS—100 ASSORTED
Over 50 values in each kit. 5 and 10% tolerances.
½ to 2 watt ..... $2.35 per kit
5 and 10 watt ..... 2.95 per kit
25 and 50 Watts ..... 5.95 per kit

TERMS—send 25% deposit with order, balance C.O.D. Shipped F.O.B., N.Y.C. (N.Y.C. residents add 3% sales tax.)

CIRCLE SALES CORP.
113 GREEN ST., N.Y. 12, N.Y. - WOrth 4-1541-2

6 Transmitters to Check
—or 60?



The new LAMPKIN TYPE 205 FM MODULATION METER covers them all; instantly tunable to any FM transmitter, 25 to 200 Mc. It measures true peaks, as found in voice modulation, up to 25 Kc. Meets FCC specifications. Portable, weighs 14 lbs., priced at **$240.00** net.

The improved LAMPKIN TYPE 105-B MICROMETER FREQUENCY METER also covers 6 or 60 channels. Measures center frequency, AM or FM transmitters, 0.1 to 175 Mc. Accuracy 0.0025%. Meets FCC specifications. Weighs 12 lbs. Price **$220.00.** Other models down to **$128.00.**

WRITE, WIRE, or PHONE, NOW, for details!

LAMPKIN LABORATORIES, INC.
MFM DIVISION
BRADENTON, FLORIDA
Frequency Measuring Equipment Since 1942

are in French; also uses 9.960 and 17.845 at 0600-0805 with programs in native to 0645, then in French. (Radio Australia)

"La Voz de la Falange," Madrid, 7.380, 1 kw., is on the air 1400-1530, 1700-1930; during July and August the station will broadcast *only during the second period. (WRH Bulletin)*

° ° °

Acknowledgement

Thanks, fellows, for the fine reports. Keep sending them to Kenneth R. Boord, 948 Stewartstown Road, Morgantown, West Virginia, USA. Good listening! . . . . . KRB.

BOOSTER FOR FM SETS

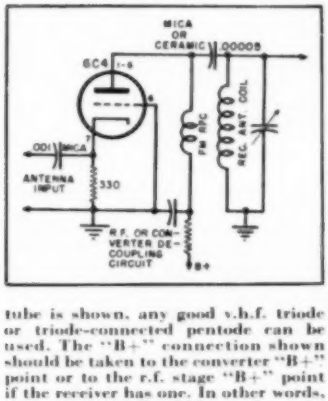
By CHARLES ERWIN COHN

MOST present-day FM receivers, even the more elaborate ones, couple the antenna to the set with a turn of wire around the antenna coil. This does not provide a very efficient coupling and it is often beneficial to make different arrangements for handling this.

One approach to this problem is shown in Fig. 1 where a 6C4 triode is used as a grounded-grid amplifier. The circuit is quite simple, the 330 ohm resistor in the cathode circuit providing a good termination for the transmission line. If a transmission line with other than 300 ohm impedance is used, the resistor will have to be changed to conform to the line employed.

The .001 mfd. condenser is used to keep the d.c. bias, which is built up across this resistor, from being shorted out by the antenna. Although a 6C4

Fig. 1



tube is shown, any good v.h.f. triode or triode-connected pentode can be used. The "B+" connection shown should be taken to the converter "B+" point or to the r.f. stage "B+" point if the receiver has one. In other words, the connection should be made at the bottom of the r.f. or i.f. coil, ahead of the decoupling resistor. This will prevent interaction with the rest of the receiver.

This circuit is capable of improving the performance of any FM set. For those receivers which already have an r.f. stage, it will improve the noise figure due to the lower noise of triodes.

For the set with no r.f. stage, the extra gain will be helpful as will the reduction in oscillator radiation. This is especially true of "Fremodyne" sets in which the performance improves rapidly with increased signal input.

—30—

ARROW "The Home of Values!"

MISCELLANEOUS SPECIALS!

	Used	New
BC 442 Loss Condenser	**$1.49**	**$1.95**
APS 13 UHF Antenna, Pair		**.98**
I-97 Bias Meter	**3.95**	**4.95**
RL 42 Antenna Gearbox Motor and Reel	**4.95**	**6.95**
Circuit Breaker 40 Amps		**.99**
I 82 F Five Inch 360 degree compass indicator and Selsyn receiver		**7.50**
A-81-2 Transmitters Selsyn for I82 indicator (Both I82F & Trans. Selsyn for $11.00)		**4.95**
PE-101 Dynamotor		**2.75**
Model 507, Thermal-converter Weston Type D, range .12 amp		**.59**
BC-1023 Marker Beacon Receiver, complete with tubes, shock mount and instruction manual		**9.95**
RC43, kit of plugs, insulators, etc, for BC-1023, new		**1.75**
BC-924 27-38 MC. FM Transmitter, complete with tubes	**19.95**	
BC-684 27-38 MC. FM Transmitter, less dynamotor	**10.95**	
ARB Control Box		**1.95**
BC 1206 Receiver, new		**7.95**
BC-375, transmitter only	**19.95**	
110 volt, 60 cycle blower		**7.95**
A27 Phantom antenna		**1.95**
PE 206 Inverter	**4.95**	
Scott Hi-Fi output transformer		**1.49**
PE-218 Inverter		**19.95**
SCR-522, transceiver, less tubes	**39.50**	
BC-709, battery operated, lt. wt., inter-phone amplifier, complete with tube, shock mount and manual, brand new **ea.**		**$3.95**
BC 625 Transmitter (SCR522), less tubes, used		**$19.95**
PE 120 Vibrator Power Supply for BC 620-659, used, less vibrator		**4.95**
TU6 Tuning Unit (BC375), used		**2.95**
TU25 Tuning Unit (BC375), used		**2.45**

MONTHLY SPECIAL!

BC 604 FM Transmitter—20-27 mc. 10 Channel crystal controlled push-button, excellent for conversion to 10 and 11 meters, small quantity on hand, in good used condition, less dynamotor, some missing side covers, etc., otherwise complete, including tubes **$7.95**

SCR 508 EQUIPMENT

BC 603 Receiver L dyn	**$24.95** Exc.	Used
BC 604 Transmitter L dyn	**12.95** Exc.	Used
BC 605 Amplifier L dyn	**6.95** New	
C 606 Control Box	**.95** Exc.	Used
A 237 Mounting	**9.95** Exc.	Used
MP 48 Mast Base	**2.95** Exc.	Used
DM 34, Dynamotor	**10.95** Exc.	Used
DM 36, Dynamotor	**10.95** Exc.	Used
DM 37, Dynamotor	**14.95** Exc.	Used
TM 11-600 Tech Manual	**1.95**	
Crystals, Set of 80	**19.95**	

SCR 625 Famous Army Mine-Detector

For Prospectors, Miners, Oil Companies, Plumbers, etc.

This unit is being offered now at a considerable reduction in price. Recently advertised at $79.50 it is now available in the same brand new wrappings in suitcase style carrying case (less batteries) at

$59.50 **WHILE THEY LAST!** **Used, like new, $39.50**

CJP-20 ABX Power unit, (ASB7) new with tubes **$4.95**
used with tubes **1.95**

COMMAND (SCR 274 N) EQUIPMENT

	Used	New
BC-453, with tubes	**$19.95**	
BC-454	**5.95**	
BC-455 6-9 mc receiver	**7.95**	**$14.95**
BC-457 4-5.3 mc transmitter	**6.95**	
BC-458	**6.95**	
T-21 ARC 5, 5.3-7 mc transmitter	**7.95**	**11.95**
T-23 ARC 5, 100-156 mc xmtr		**49.50**
BC-696, 2 position Rec. Control Box		**1.95**
MC-215 Mechanical Drive Shaft, per length		**2.45**
BC-450 3 Receiver Remote Control		**2.95**
BC-451 Transmitter Control Box	**.69**	**1.50**
BC-442 Antenna Relay, complete		**3.95**
3 Receiver Rack	**1.95**	

MIKES and HEADSETS

HS 23 High Impedance Headset . . . . . now **$4.95**
HS-33 Low Impedance Headset **5.95**
CD-307 Ext. cord for HS 23-33 . . . . like new **.95**
T-32 Desk Stand microphone. Good used cond. **$2.95**
Throat Mike—T-30—New **98c**
Lip Mike—Navy Type—New **98c**
Extension Cord and Switch Assembly for lip and throat Mikes—New **98c**
CW 49505 High impedance headset complete with leather headband and rubber cushions. Used **98c**
RS-38, Microphone . . . . . now **4.95**
TS 10 sound powered HAND SET . . . . now **$9.95** ea.
used **$5.95** ea.
HS-30 . . . . . now **$2.29**

WOBULATOR
See page 43—December "Radio News" **$5.95 ea.**

CONDENSERS 19c each 6 for **$1.00**
1 mfd.—800 VDC; 1 mfd.—400 VDC
.1 mfd.—1200 VDC; 1-2-4 mfd.—400 VDC
1 mfd.—1200 VDC; .1-1—2000 VDC
39c each 3 for **$1.00**
.25 mfd.—1500 VDC; 1 mfd.—1000 VDC
2 mfd.—220VAC

CATHODE RAY TUBES

3FP7 - - - 1.95 **4AP10 - - $ .95**
5FP7 - - - 1.95 **5CP1 - - - 3.95**
5BP4 - - - 3.95
16JP4 - - - - - - - - - - $19.95
16DP4 - - - - - - - - - - 19.95

90 DAY GUARANTEE

Tubes—304TH	**$0.95**
304TL	**0.95**
830B	**2.95**
9001	**1.39**
9002	**.98**
9003	**1.49**

Write for complete bargain tube list

VIBRATORS

2 Volt—7 Prong Synchronous **69c** 10 for **$6.00**
6 Volt—4 Prong Non-synchronous **98c** 10 for **9.00**

I. D. 6B APN4
LORAN INDICATOR SCOPE
less tubes, like new **$29.95**
ONLY . . .
R9 APN4, complete with tubes, like new **$17.95**

Shipments FOB warehouse. 30% Deposit on orders. Minimum order $5.00. Illinois residents, add regular sales tax to remittance. Prices subject to change without notice.

ARROW SALES, Inc. Dept. N, 1712-14 S. Michigan Ave., Chicago 16, Ill. PHONE: HArrison 7-9174

Free NEW BIG RADIO CATALOG



Ready now. Complete with everything in radio, television and electronics. Newest parts, as well as old, standard lines. Paste coupon on penny postcard and mail today!

Lafayette Radio
DIVISION: RADIO WIRE TELEVISION, INC.

NEW YORK 13 — 100 Sixth Ave.
NEWARK 2 — 24 Central Ave.
BOSTON 10 — 110 Federal St.
BRONX 58 — 542 E. Fordham Rd.

LAFAYETTE RADIO,
Dept. RC
100 Sixth Avenue, N. Y. 13

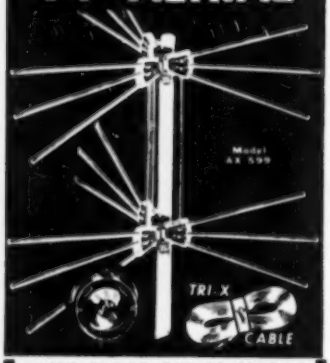
Please rush Free catalog to:

Name .....
Address .....
City ..... State .....

PASTE ON PENNY POSTCARD

WHERE TO BUY IT . . .
WHOLESALE RADIO
of Baltimore

Replace Your Old TV Aerial
With Snyder's Amazing New
360° MOTORLESS
TV AERIAL



SAME CLEAR PIX AS MOTOR ROTATING AERIAL SYSTEMS COSTING TRIPLE THIS PRICE

only $16.95

COMPLETE WITH 75 FT. OF 3 COND. CABLE AND ELECTRONIC BEAM SELECTOR SWITCH

FOR ULTRA FRINGE
Electronically beams in complete 360° rotation to give clear picture on all channels. You choose direction with Directronic Selector switch mounted on or near TV set. 18 hi-tensil ¾" aluminum alloy elements. Has universal U clamp to fit masts up to 1¼".

YAGI TV ARRAYS
For Fringe & Ultra Fringe



Highly directional and closely tuned to each channel. Cuts interference and noise to a minimum. Five elements: one folded dipole, three directors and one reflector. Individual array for each channel. Specify channel desired.

$7.95 $4.95

FOR BOOM for stacking 2 Yagi Arrays 85c

Specify Hi or Lo band ..... pair

HI-FI MUSIC AMPLIFIER
GROMMES
50PG



10 watt audio. Low distortion. Freq. response ± or minus 3 DB 20 to 20,000 CPS. 4 channels: radio, phono, mic, magnetic. Vol., bass, and treble controls. Complete with tubes and output transformer.

$49.75

3 Speed 12"
Turntable
REK-O-KUT LP743



Induction type motor, designed for smooth, vibration free operation. Instantaneous speed changes without stopping turntable or touching disc.

$54.95

Order From Dept. BN-3 or Call MUlberry 2134
WRITE FOR FREE TYL BULLETIN

WHOLESALE
RADIO PARTS CO., Inc.
311 W. Baltimore St.
BALTIMORE 1, MD.

Saturable Reactors

(Continued from page 69)

light bulb of the proper wattage as the load so that the control effects can be observed visually.

When all the connections have been made, with the d.c. power off, plug in the a.c. load circuit. At this point the bulb will be either completely extinguished or else very dim. Now turn on the d.c power supply and slowly increase the current. The brightness of the bulb will increase in proportion to the current, reaching its maximum brightness at approximately 44 ma.

When the core is fully saturated at full d.c. current and the bulb is at its maximum brightness it will be found that the voltage appearing across the bulb is less than the actual line voltage (approximately 100 v.). This is due to the fact that the reactance of the coils cannot be decreased to exactly zero. As a result there will always be some drop across the reactor. In commercial applications this is corrected by providing a supply voltage which is about 5% higher than the normal operating voltage of the controlled unit.

At the other extreme it will be found that the lamp voltage does not drop to zero, since the reactor cannot be infinite in value. This of course means that the load current cannot be decreased to exactly zero. However in the case of a lamp load it will "black-out" at approximately 15% of full line voltage. When a resistive load is used the two voltages, across the reactor and across the resistive load, are 90 degrees out-of-phase. When the load is also reactive, for example a motor, the voltages will be in-phase. The net result of all this is a slight reduction in the control range.

In the next arrangement the two a.c. coils will be connected in parallel. Again following standard convention the finish of primaries #1 and #2 are connected together and the start of these same windings are connected together. The start ends are connected to the a.c. line and the finish ends are connected to the light bulb and then to the other side of the line (coils in series with load unit). The d.c. coil connections are not changed. The actual schematic of this circuit is shown in Fig. 6B.

When using this connection it will be found that the d.c. control current needed is only one-half of that required for a series connection of the a.c. coils. It will also be found that the unit will operate much more efficiently in this arrangement. This results from the fact that the primaries were originally designed to operate on 117 volts.

If desired, a small fractional horsepower motor can be substituted for the light bulb. Its power rating must be approximately the same as the light bulb used. For this purpose, the type of motor used in erector sets or small movie projectors is the proper size, but it must be a 117 volt a.c. type.

It is necessary to observe certain precautions, because when a motor first starts it draws an excessive line current which is higher than its normal value at full speed, with the consequent danger of overloading the unit. To avoid this a shorting switch is connected across the a.c. coils so that full line voltage can be applied to the motor. Once the motor is started the switch is opened, changing the control of the motor to the saturable reactor.

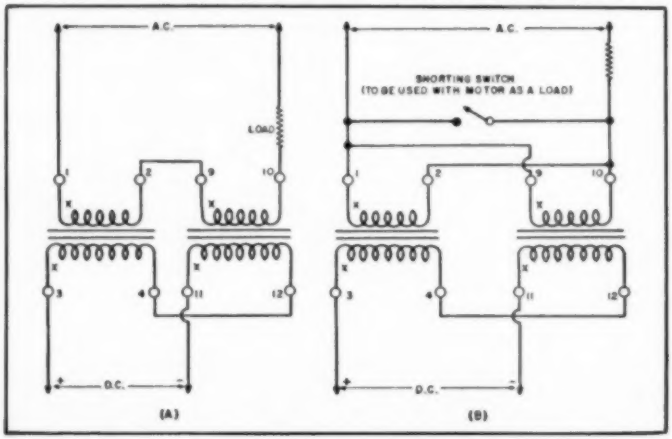
In order to simplify specific arrangements and procedure the foregoing explanation has been based on the ratings of a 40 ma. power transformer. However, units have been built using 70 ma., 90 ma., and 150 ma. transformers and the system is exactly the same when any of these are used.

The gain of the unit can be calculated by the following formula:

$$gain = \frac{output\ power\ (a.c.)}{input\ power\ (d.c.)}$$

The gain of the small unit is relatively

Fig. 6. Saturable reactor with a.c. coils connected in series (A) and in parallel (B).



low, but as the size of the unit is increased the efficiency also increases which means that the gain is higher. The cores used are made of 4% silicon steel which operate best at high power levels.

Manual control has been used in this presentation to avoid complications. There are several very interesting ways in which these units can be controlled by means of regular electron tubes.

In the beginning of this article it was pointed out that a multiple control unit can be made by making use of the low voltage windings, making possible control based on multiple input signals. Once the unit is assembled it is merely necessary to connect the proper type of control unit to each set of windings. Since the windings are different from the high voltage windings the control conditions are entirely different. Therefore it would be necessary to experiment in order to determine the best control conditions for each of the various voltage windings. —30—

SERVICE HINT

By H. LEEPER

IN order to see clearly in some remote corner of the TV or radio chassis when soldering, additional light other than that furnished by the usual solder gun is required.

Such light is easily obtained from the gun itself, by making an extension lead as shown in the photograph below.

The base from an old flashlight bulb with two wires attached is inserted in the socket of the gun instead of the regular bulb. The bulb which was removed is placed in a socket soldered to the other ends of the wires. A portion of the rubber insulation from a test clip may be slipped around the extended socket so that it may be used any place without danger of shorting to the chassis.

—30—

Add an extension light to your solder gun.



Be "ECONOMY-WISE" with **GREYLOCK** TERRIFIC TUBE BUYS!

All tubes listed below carry 6 month Guarantee—excepting only burnouts and breakages. At these sensationally low prices, these tubes must be ordered in quantities of AT LEAST 10 ASSORTED TYPES—add 10% for orders under 10 tubes. All individually boxed in attractive Greylock Cartons.

1L4 6AT6 6J5GT 12AU6
1S5 6AU6 6J7GT 12AB8GT
1U4 6AV6 6S4 12BA6
1U5 6BA6 6SK7GT 12F5GT
3Q4 6BE6 6V6GT 12BE6
3V4 6C4 6W4GT 25Z5
5Y3GT 6C5GT 6X4 35W4
6AL5 6C6 6X5GT 35Z5GT
6AQ5 6CB6 12AT6 117Z3

YOUR NET COST EACH 49¢

1V2 6BC5 12AX4GT 12SQ7GT
5U4G 6SA7GT 12BA7 25Z6GT
6AB4 6SL7GT 12J5GT 35Y4
6AQ6 12AL5 12Q7GT 50B5
6AS5 12AV7 12S8GT 80

YOUR NET COST EACH 69¢

1LA4 1X2 6BJ6 6SG7
1LN5 6BH6 6J6 7A8
1N5GT 12AT7

YOUR NET COST EACH 89¢

0Z4M 6AR5 12AU7 35B5
1R5 6R7GT 12AV6 35C5
1T4 6SQ7GT 12AX7 50C5
3S4 6SN7GT 12SK7GT 50L6GT
5X4G 6U4GT 25L6GT

YOUR NET COST EACH 59¢

1LC5 6BQ6 7N7 12SN7GT
6AG5 6T8 7X7 25BQ6GT
6AK5 6Y6G 12K8GT 35L6GT
6AK6 7A7 12SA7GT
6BA7 7E5

YOUR NET COST EACH 79¢

12BH7 6AC7 14C5 7C7
19T8 32L7GT 1A7GT

YOUR NET COST EACH 99¢

6BG6G	$1.09	12AZ7	$1.29
19BG6G	1.09	6AM6	1.29
1B3GT	1.19	6BQ7	1.49
6AG7M	1.19	6V3	1.59
6CD6G	1.29	807	1.79
6BL7GT	1.29	7JP4 CRT	16.90

SPECIAL—6AR6 ..... $2.49

SPEAKER SPECIALS
Permanent Magnet—Alnico No. 5 Slugs
2" PM, 68 oz. $1.09
4" or 5" PM, 68 oz. 1.29
6" PM, 1.0 oz. 1.59
6½" PM, 3.16 oz. 3.49
8" PM, 2.15 oz. 2.69
10" PM, 6.5 oz. 3.95
12" PM, 3.2 oz. 4.95

AUTO SPEAKERS
2¼" 4 ohm dynamic less output $2.10
2¼" PM less output 4.95

HIGH VOLT. FLYBACK TRANSFORMER 14K VOLTS
Used for 16", 17" round or rectangular tubes. Good for conversion and replacement use. Many new extra, used tube & shock terminator in their sets and paid more than this for them. Order #B-2012 Each, ONLY $2.09

GREYLOCK "BONDED" ELECTROLYTIC CONDENSERS
Guaranteed Fresh Stock

Lots of 10—Your Assortment

Mfd.	W.V.DC	Net each	Mfd.	W.V.DC	Net each
10	150	$0.29	40 x 40	150	.45
24	150	.35	50 x 30	150	.45
30	150	.35	8	450	.29
40	150	.39	8 x 8	450	.49
20 x 20	150	.39	16	450	.39
20 x 40	150	.39	30	450	.44
30 x 30	150	.44	40	450	.49

Above prices are for minimum quantities of 10 assorted condensers. Deduct additional 10% discount in lots of 100 assorted condensers.

4 ELEMENT CONICAL ANTENNAS
Constructed of reinforced butt seam aluminum elements and strong steel cross bars; ruggedized insulators.
SINGLE Order #P-003 ..... $3.99
STACKED Order #P-004 ..... $8.29
Extra elements for conicals to make fan-flector type.
P-009—Low Band Elements, each 49c
P-010—High Band Elements, each 35c

CHIMNEY MOUNTS #E-1585 ..... Only 99c

WHILE THEY LAST!
FAMOUS MAKE TV BOOSTER
List 32.50—Order #Q-001 16.95

MANY ADDITIONAL VALUES!
Write for our latest supplement and complete Catalog N-3

TERMS: Net C.O.D., F.O.B. New York City. 25% Deposit on all C.O.D. orders.

A Trusted Name in Radio
GREYLOCK ELECTRONICS SUPPLY CO.
115 Liberty Street - New York 6, N. Y.

SENSATIONAL SURPLUS ELECTRONIC ASSORTMENT



Remember—1 Coaxial Antenna Motor Alone Is Worth the Price of the Entire Assortment

COMPLETE ASSORTMENT ONLY $19.95 A small Fraction of the original cost.
10% OFF on All Orders of 5 Kits or More
Terms: 20% Deposit with order. Balance C.O.D. F.O.B. N.Y.C.

LIMITED NUMBER! WHILE THEY LAST! EACH ASSORTMENT CONSISTS OF THE FOLLOWING—

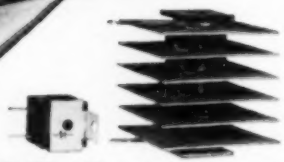
2—24 Volt D.C. Coaxial Antenna Switching Motors; 2—Oil Cond. Upright Mt., .02 MFD x 8000 V. DC; 2—Oil Cond. Upright Mt., .01 MFD x 5000 V. DC; 1—Oil Cond. Upright Mt., .1 MFD x 3000 V. DC; 1—Oil Cond. Upright Mt., 5x3 MFD x 150 V. DC; 2—Oil Cond. Upright Mt., 1—1 MFD x 600 V. DC; 1—wire wound Potentiometer 2000 OHMS; 4—wire wound Potentiometer 20,000 OHMS; 2—wire wound Potentiometer 100,000 OHMS; 2—wire wound Potentiometer 250,000 OHMS; 1—Range Switch; 1—Filter Choke; 1—Mica Cond. .005—2,500 V. DC; 1—R. F. Choke; 1—Noise Filter Choke; over 20 other Oil & Mica Cond.; over 40 Resisters 2 W to 15 W; also Fuses, Bulbs, Grid Caps, Hardware; numerous other items; All Parts New, individually boxed, in Mfrs. Original packing; Shipping Weight 24 lbs. Complete with list of parts.

REFONIC SALES CO., 397 Mosholu Parkway North, Bronx 67, N.Y.

Sarkes Tarzian

"Centre-Kooled"

SELENIUM RECTIFIERS



Just Off The Press—

Most complete book of its kind ever published . . . 80 pages of valuable information about Selenium Rectifiers . . . 48 pages of Radio and Television circuit diagrams . . . 20 pages on Power Rectifiers . . . 3 pages on High Voltage Rectifiers . . . a 7 page cross index replacement guide. Send 50c for your copy or see your distributor.

Sarkes Tarzian, Inc., RECTIFIER DIVISION
Dept. R-1, 415 N. College Ave.,
Bloomington, Ind.

HEY, MAC!

ONLY $2.95

3-TUBE AC-DC PHONO AMPLIFIER KIT

Easy to build with our big pictorial and schematic diagrams. Plays with excellent fidelity and volume. Complete with pre-punched chassis, parts and tubes. Uses 1/2 6SJ7, 6V6 and 5Y3 tubes and small amount of wire and solder required. Operates on 105-120 Volts AC or DC. A big buy for little money.

Kit of 3 tubes for amplifier $2.46
5" Alnico PM Speaker 2.19

VOCATRON PORTABLE WIRELESS INTERCOM

No special wiring or installation required. Operates on any 105-125 volt AC or DC lighting circuit over distances up to ½ mile. Extra units may be added for multiple station system. Send plastic cabinets measure only 6¾" x 4¾" x 2¼". Complete with tubes, ready for instant use. Per pair $79.50
Extra Vocatron Intercom Unit 39.75

High-Gain Conical Antenna

$3.75 each in lots of 10
$4.25 singly

A-547

High-gain conical for all channels. Packed directional response. Durable aluminum with unbreakable molded polystyrene insulators and many other exclusive features. Elements may be stacked.

300-ohm Twin Lead $2.50 per 100; $19.95 per 1000
5 ft. Aluminum Mast ..... $1.03 singly
93c each in lots of 10

STAR ELECTRONIC DISTRIBUTORS, INC.
Dept. RN-3 7736 S. Halsted, Chicago 20, Ill.



Low Cost Powerful P. A.!

COMPLETE • READY TO USE

Tops for powerful indoor-outdoor use; ideal for electioneering. Easy portability. Covers 4,000 persons indoors, up to 25,000 sq. ft. outdoors. Full 30 watts usable output; 2 high-imp. mike inputs, 1 phono input, each with separate volume control; tone control; fidelity ±2 db from 40-20,000 cps. Complete system includes: 30 watt amplifier and tubes, Electro-Voice "Cardax" unidirectional mike with adjustable floor stand and 20' cable; 2 General Electric 12" PM speakers, each with 30' cable; portable carrying case holds all, 16½ x 12¾ x 25". For 110-130 v., 60 cy. A.C. Shpg. wt., 75 lbs. Complete, less only phono top.

93-372. Complete 30 Watt System. *Only* **$119.75**
93-340. 3-Speed Phono Top for above. *Only* **$16.95**
Available on Easy Terms—write for details

FREE See the 212-Page ALLIED Catalog for other Sound Systems, ranging from 8 to 80 watts. Write for Free copy of Radio's leading Buying Guide today.

ALLIED RADIO
833 W. Jackson Blvd., Dept. 1-CA-2, Chicago 7, Ill.

Interlacing Troubles

(Continued from page 65)

cuits are available which provide more accurate vertical synchronizing than does the integrator.

Vertical A.F.C.

Most current television receivers use flywheel synchronization to keep the frequency of the horizontal oscillator from being changed from one line to the next by noise. A similar system can be used to keep the frequency of the vertical oscillator from being changed from one field to the next by interference from horizontal sync or deflection signals. There is one receiver available using such a circuit, the *Radio Craftsmen* RC-100 (RADIO & TELEVISION NEWS, February 1950, pages 51-53). The vertical deflection circuit of this receiver is shown in Fig. 2.

Some technicians will notice that this circuit is similar to one used by *Emerson* and others, for horizontal a.f.c. Positive and negative sync pulses are obtained from the inverter and applied to the sync discriminator, along with a signal from the vertical amplifier. The output voltage from the sync discriminator, which depends upon the phase relation between the sync pulses and the receiver deflection signal, is amplified and applied to the vertical oscillator as bias, to control its frequency. The synchronizing pulses are not applied directly to the oscillator and the control voltage is prevented from changing rapidly by C_{36}. One novel feature of this circuit is that the deflection signal for comparison with the sync pulses is obtained from the screen of the 6AQ5 vertical output tube. This electrode has no d.c. voltage applied to it, but the vertical signal is coupled from the plate to the screen by interelectrode capacity. The vertical oscillator plate voltage is not obtained from the damper in this receiver, so that possible source of horizontal interference is removed.

A theoretical disadvantage of a.f.c. for the vertical circuit is that it is *too* stable. When the video signal source is changed, at a station break or when switching channels, the picture at the receiver generally rolls through part of a frame before becoming stationary again. The reason, of course, is that the new vertical signals are not inphase with the previous ones and the receiver phase must be changed to correspond. If the time constant of an a.f.c. system is made short so that the speed of the receiver's phase change can be very rapid, its immunity to interference will be reduced.

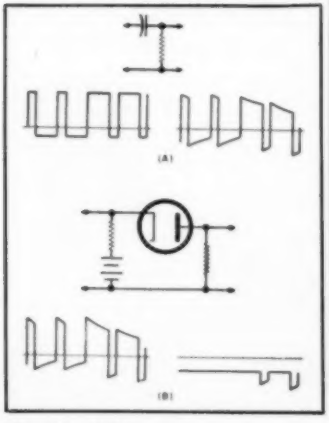
Vertical Separators

Several other circuits have been developed, some of which offer advantages over both the integrator and a.f.c. Apparently none of these has been used in a regular production model American television receiver, possibly because few complaints have

been received by the manufacturers about the performance of the integrator circuit and because these circuits are more expensive than the integrator, although less expensive than a.g.c.

A method of vertical sync separation which makes it possible to obtain a sharper output pulse than that of the integrator and faster action and less cost than a.f.c. uses a differentiator followed by a clipper. A simple circuit of this type was outlined by P. Mandel, *Radio-Industrie*, Paris, France, in "An Experimental Large-Screen Television Projector," *Proceedings of the I. R. E.*, December 1949, page 1464. (See Fig. 3.) A positive composite synchronizing signal is applied to a differentiator having a time constant comparable to a line interval. The output of the differentiator consists of positive pips at the beginning and negative pips at the end of each horizontal sync pulse, equalizing pulse, and section of the serrated vertical pulse. The negative output pip in each case begins at the level reached by the trailing edge of the positive pip. During the short horizontal sync and equalizing pulses the condenser cannot assume much of a charge and the output voltage across the resistor cannot fall very far. Therefore the pips which come at the end of the horizontal and equalizing pulses begin at a large positive value and do not reach a very large negative value. In the case of the much longer vertical sync pulses the condenser has a longer time to charge and the voltage across it reaches a higher value, while the voltage across the resistor falls to a lower value. Hence the pips which appear in the output at the end of each vertical pulse begin at a less positive value and extend to a more negative value than the pips following the horizontal and equalizing pulses. A clipper can, therefore, be used to pass only the pulses corresponding to the notches in the vertical synchronizing pulse. Short noise pulses will be rejected in the same manner as horizontal and equalizing pulses.

Fig. 3. Vertical sync separation by means of differentiator (A) and diode clipper (B).



Tube Prices SMASHED!

Dependable performance and economical service are two outstanding features overshadowing even these sensationally low-low priced, high quality, fully guaranteed tubes. Every tube must pass rigid tests in our plant. You can compare RAD-TEL tube performance and quality with any standard tube anywhere.

80% to 90% off list!

Check this list for Fully Guaranteed Tubes

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
1A6	.59	5AZ4	.39	6BL7	.59	6T8	.56	14J7	.55
1A7GT	.47	5U4G	.40	6BN7	.79	6U5	.44	14W7	.55
1AB5	.59	5V4G	.54	6BQ6GT	.59	6U8	.59	19BG6G	.59
1B3	.49	5Y3GT	.32	6C4	.37	6V6GT	.39	19T8	.79
1B5	.59	5Y3G	.32	6C5GT	.39	6W4GT	.44	25BQ6GT	.62
1B7GT	.59	5Y4G	.35	6CB6	.44	6W6GT	.44	25L6GT	.39
1C5GT	.43	5Z3	.39	6CD6G	1.11	6X4	.37	25Z5	.40
1G6	.53	6A3	.59	6E5	.48	6X5GT	.37	25Z6GT	.37
1N4	.46	6AB4	.44	6F5GT	.39	6Y6G	.48	32L7	.65
1N5GT	.40	6AC7	.45	6F6G	7F6	.43	25Z5	.40	
1L4	.46	6AG5	.43	6F6GT	7X6	.39	35C5	.39	
1L6	.43	6AJ5	.90	6G6G	.52	7Z4	.37	35L6GT	.41
1LC5	.51	6AK5	.75	6H6GT	.41	12AB6T	.46	35W4	.37
1LC6	.48	6AL5	.38	6J5GT	.37	12AL5	.37	35Z5GT	.37
1LN5	.51	6AQ5	.39	6J6	.52	12AT6	.37	36	.49
1N5	.46	6AQ6	.39	6J7G	.43	12AT7	.56	41	.42
1P5	.57	6AR5	.37	6J8G	.63	12AU6	.38	42	.42
1R5	.45	6AT6	.37	6K6GT	.37	12AU7	.43	43	.55
1S5	.39	6AU6	.38	6K7G	.44	12AV6	.39	45	.35
1T4	.45	6AV6	.37	6K7GT	.44	12AV7	.59	80S5	.39
1T5	.53	6B4G	.64	6L6G	.64	12AX4	.48	80C5	.39
1U4	.45	6B5	.64	6L6GA	.64	12AX7	.48	80C6	.59
1U5	.39	6BA6	.39	6S4	.38	12BA6	.38	80L6GT	.41
2A3	.39	6BC5	.44	6S8	.53	12BA7	.46	80X6	.53
3A4	.45	6BD5GT	.39	6SA7GT	.43	12BE6	.39	80Y7	.50
3B5	.46	6BE6	.39	6SD7GT	.41	12K7GT	.46	70L7GT	1.09
3Q4	.48	6BF5	.41	6SG7GT	.41	12Q7G	.39	76	.44
3Q5GT	.49	6BF6	.37	6SJ7GT	.41	12SA7GT	.44	80	.33
3S4	.46	6BG6G	.94	6SK7GT	.41	12SK7GT	.48	117L7	.89
3V4	.47	6BH6	.46	6SL7GT	.48	12SL7GT	.47	117Z3	.37
5AX4	.37	6BJ6	.39	6SN7GT	.52	12SN7GT	.52	807	.99
				6SQ7GT	.37	12SQ7	.44	1274	.99
				6SR7	.37	12SR7	.49	1276	.99

PICTURE TUBES . . .

14BP4 . . . 14.50 16RP4 . . . 19.50

17BP4 . . . 19.50

Rad Tel TUBE CO.

"Integrity Is Our Chief Asset"

TERMS

A 25% deposit must accompany all orders—balance C. O. D. All shipments FOB Newark warehouse. Orders under $5—$.50 Handling Charge. Subject to prior sale.

32 BEECHER STREET

NEWARK, NEW JERSEY

$$ SAVING SPECIALS $$

VARIAC GENERAL RADIO CO. 200C 5 to 710 AMP 115AC in or 235AC out from new equip. $10.50
METER 0-150VAC Weston or West, 2" R iron vane 9.00
MOTOR 4 pole shaded pole induction 1700 RPM G.E. 1/50 HP running torque 12 oz. inches list $12.00. F face wire or base mounting 3.50
HEADSET TELEX transmit Mod. 2370 reg. 14.00 ..... 9.95
MICROPHONE SHURE 700C CAST desk stand 5.95
SPEAKER 6" R 3 ohm VC 3 oz. Alnico 5 PM 1.75
SPK 4JK 3 ohm VC 3 oz. Alnico 5 mag. PM 1.95
SPK. LAS Grade 1 & 2 Navy water proof BCA twists, flashes, Phone, water wiring type, ea. ..... .15
MAGNETIC OVERLOAD RELAY A.B 810.40 Mil to 200 mil also 12 to 18 AMP and 15 to 43 Amp. 600 V max. dust and water choice 2.95
CURRENT RELAYS WESTINGHOUSE type sc 2 ..... 3.95
RECTIFIERS Full set 400/0/2797 CHR Mil 110V ..... .75
CIRCUIT BREAKERS Heinemann Cat. 0711 5 amp 115VAC curve B1 2 pole Amp 1.60
POWER TRANS. Thordarson 70H62 350-350 145 mil 5V 3 Amp 6.3V 4.5 Amp used equip. 2.95
OUTPUT TRANS. BCA pair 6L6 class AB 16 watt 4-8-16-250 ohms plate to plate 1.50
CHOKE THORDARSON 13C90 8 H. 150 Mil 1.25
CHOKE THORDARSON 4 H. 300 Mil encased 4.50
CHOKE CHICAGO trans. Co. 6 H 80 mil 50 ohm ..... .75
1000 MFD 15 VDC Sprague C431A Condenser ..... .95
3900 X 3500 MFD 25VDC Sprague DZP 4 pin can. 1.50
RXB MFD VDC oil filled Tube 4 pin can. ..... .85
SCOPE TUBES 5BP1 5BP4 5CP1 5FP7 ..... ea.
XTALS 2 meters 146.16 MC DC8 holder 2.50
XTALS 500 KC standards CR-28/U special 2.00
BC453 190 to 550 KC receiver brand new 18.50
BC696 3 to 4 mag transmitter, brand new 24.50
BENDIX TA12B trans. front end 4 section tuner covers 1650 KC to 7 MC uses 6SK7 tubes new 9.95
AIRCRAFT EQUIPMENT BC1459 27.9 to 28.7 MC transm **BY-11 & 12 WN-2GC & 1.8 BC1023 C-45** ..... **ARC-1 1-182** incl. **BC-347 Amp. AIC-AM20** interphone amp. **BY-23 AMC3 BC732** cond., hood **DM53A** etc. prices on request.

Include postage with order. Min. order $3.00

McCONNELL'S 2834 Germantown Ave. Phila., Penna. RA 6-6033

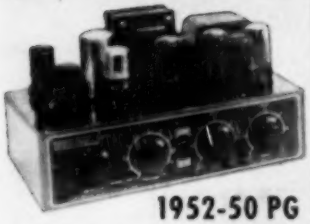
"WE'RE TEARING OUR HAIR OUT . . ."



to buy desperately needed equipment such as ART-13, BC-348, BC-224, BC-342, BC-312, ARC-1, BC-221, RS-ARN-7 or components. In fact, we'll buy any parts or accessories no matter how small. For speedy, efficient service and a real honest deal, phone, wire or write:

V & H RADIO & ELECTRONICS SUPPLY CO.
2033 W. Venice Blvd., Los Angeles 6, Calif.
Telephone: REpublic 3-1127

GROMMES
AMPLIFIERS



1952-50 PG

A 10 watt high fidelity single unit amplifier with unusual performance. It features extended frequency response with low distortion and plenty of reserve power. Ideal for conservative custom installations.

THE GROMMES 215BA
"WILLIAMSON"



. . . newest addition to the famed Grommes Custom Line.

THE G SERIES



A complete line of P. A. and commercial amplifiers.

New TV CLARIFIER

Actually has FOUR TIMES the interference "Suck" of previous model.



See your Jobber or
WRITE FOR CATALOG

Precision Electronics, Inc.
641-643 MILWAUKEE AVE
CHICAGO 22, ILLINOIS

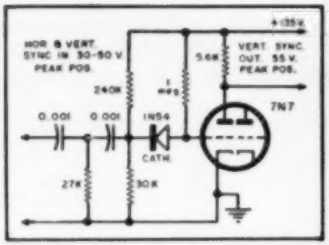


Fig. 4. Vertical sync separator and limiter.

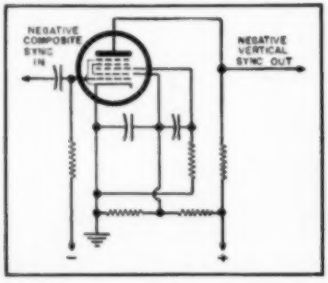
A circuit based upon the same principle was presented by Robert C. Moses, *Sylvania Electric Products Inc.*, in "Improved Vertical Synchronizing System," *Electronics*, January 1951, pages 114-118. (See Fig. 4.) Here the output of the differentiator is applied to a crystal diode biased so as to pass only the negative pips corresponding to the vertical notches. These pulses are then amplified, inverted, and limited by the triode circuit.

This type of vertical separator circuit can be added to most existing television receivers without much trouble. The parts other than the tube would not occupy much more space than the integrator; for the extra triode one of several provisions could be made. Some receivers have unused socket holes on their chassis. In those which have a single triode vertical oscillator, a twin triode in the same socket can be used as oscillator and vertical sync clipper. In other cases, separate oscillator and amplifier tubes can be replaced by a twin triode to free one socket for the sync clipper. In almost any case, a vector socket turret could be used to add another socket.

Differentiator-Heptode Clipper Vertical Separator

An earlier circuit, in which the same principle is applied in a different and slightly more effective manner, was described by J. Hanntjes and F. Kerkhof, of *N. V. Philips' Gloeilampenfabrieken*, Eindhoven, The Netherlands, in "Home Projection Television, Part III, Deflection Circuits," *Proceedings of the I. R. E.*, March 1948, pages 408-409. (See Fig. 5.) In this circuit the negative composite synchronizing signal is applied to a differentiator having a

Fig. 5. The differentiator-heptode clipper and vertical sync separator circuit.



PERFORMANCE
Not Size
IS WHAT COUNTS



JFD

"LITTLE GIANT"
LIGHTNING ARRESTER
PROTECTS
Against Lightning Hazards

No. AT 105 — For ribbon-type and oval jumbo twin lead. $1.25 LIST

ONLY JFD Lightning Arresters offer you these exclusive patented features:

1. Strain-relief Retaining Lug prevents pulling or straining of lead against contact points.
2. You actually see positive contact made with lead-in wire.
3. No wire stripping or cutting.

Write for Form No. 84 showing the damage lightning can do to a Television installation.

JFD MANUFACTURING CO., Inc.
6127-39 16th AVENUE, BROOKLYN 4, N. Y.

The **APRIL** Issue of
RADIO & TELEVISION NEWS will be on sale
April 1st

EVERY RADIOMAN
Can Use These
SERVICE HINTS!
Valuable Manual Yours—FREE!



Every page of "How to Simplify Radio Repairs" is packed with on-the-bench, practical ideas. Contains photos, charts, diagrams—no fluff—no vague theory. In plain every-day language it gives you priceless suggestions—new servicing ideas. You'll use and benefit from the experience of experts. Partial list of contents: How to Localize Trouble; How to Service Amplifiers; How to Test for Distortion; How to Test Audio Circuits; How to Test Speakers; How to Find Faults in Oscillators; How to Test Radio Parts—and it's all yours—FREE! No obligation.



FEILER

SEND COUPON OR PENNY POSTCARD FOR YOUR FREE COPY TODAY!

FEILER ENGINEERING CO., Dept. 3H2
6026 N. Monticello Ave., Skokie, Ill.
Suburb of Chicago!

Please RUSH my FREE copy of "How to Simplify Radio Repairs."

Name .....
Address .....
City ..... Zone ..... State .....

time constant of approximately one-half line interval. In the output of the differentiator larger positive pips occur at the time of the vertical notches than after the horizontal and equalizing pulses. These pips are applied to the first grid of a heptode, which is biased so that current flows only during the vertical notches. During the first notch plate and screen current flow and both voltages fall. The screen bypass condenser has a relatively small capacity, so that the screen voltage can fall appreciably during this time. Since the third grid is connected to the screen through another condenser, the decrease in positive screen voltage makes the third grid go negative until the condenser has time to charge. The third grid is driven sufficiently negative to cut off plate current even while the bias on the first grid allows screen current to flow. The time constant in the circuit of the third grid is long enough to keep plate current cut off until the remaining notches in the vertical pulse have passed. The result is that the only signal at the plate of the tube is a short negative pulse of voltage at the time of the first notch in the vertical sync pulse.

In the original *Philips* circuit, the heptode vertical separator was one section of a dual-section tube, the other section being a triode used as the vertical oscillator. No available American tube is equivalent. All of our triode-heptodes have the grid of the triode section connected internally to one of the grids of the heptode. Several alternate courses are open to the American experimenter desiring to try the circuit:

First, to use a European triode-heptode. The ECH4, which has a 6.3 volt, .35 ampere, heater, is available from *North American Philips*. It has a European type base, however.

Second, to use an American triode-pentode, connecting the three grids of the pentode as the first three grids of the heptode are connected in the circuit of Fig. 5. Only one American type is usable. Most of our triode-pentodes have the third grid of the pentode connected to the cathode internally. The recently announced type 6X8 nine-pin miniature has separate connections for the plates and all of the grids of both sections, although there is a common cathode connection.

Third, to use a separate heptode for the vertical separator tube. Several pentagrid mixers and pentagrid converters are available which could be used.

Fourth, to use a separate pentode, connecting it as described under the triode-pentode. In this case, it would be preferable to use a pentode in which the suppressor is constructed to be an effective second control grid, such as the 6AS6 or 7AK7, although other sharp cut-off pentodes would probably work.

Fifth, to use a gated-beam tube, type 6BN6. The limiter grid of this tube produces an unusually sharp cut-off.

—30—



TOP QUALITY! LOW COST!

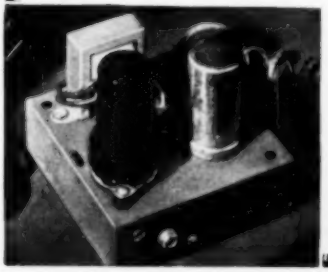
FISHER

HIGH QUALITY

Phonograph Preamplifier

■ Here is the *top* quality, *reasonably priced* preamplifier you have always wanted. The FISHER provides exact equalization for low-level magnetic pickups of *any* make, such as GE, Pickering, Audax, Clarkstan and others; also used as a microphone preamplifier.

List $20.95



Outstanding Features:

Uniform response, 30 to 20,000 cycles. Self powered. Two stages of triode amplification. Extremely low hum.

Full low-frequency equalization. High gain. Completely enclosed chassis with bottom cover. Plugs supplied.

Output cable can be up to 50 feet in length. SIZE: 3¾ x 3⅛ x 3⅝ high.

WRITE FOR FULL DETAILS

FISHER RADIO CORPORATION
39 E. 47TH ST., NEW YORK

PEAK FOR VALUE!

Power Transformer Bargains

115 Volt, 60 Cy. Primary. 800 Volts CT. @ 250 MA., 6.3V @ 4A, 6.3V @ 4A, 6.3V @ 2A, 5V @ 2A, 5V @ 2A. Fully Cased. **$7.89** ea.
BRAND NEW. Wt. 14 Lbs. Only

750 Volts CT @ 300 MA., 6.3V @ 10 Amps. 5YC 3A. Fully cased, removed from TV equipment. Guaranteed $3.75 ea.

SCOPE TRANSFORMER BARGAIN
2500V @ 3 MA., 2.5V @ 2A, 6.3VC 6 Amp. Removed from TV equipment. Terrific value. Guaranteed $1.89

SENSITIVE RELAY
D'arsonval moving coil type, mounted in metal case. Adj. 700 microamps to 2 ma. Made by Triplett. ea. **$5.75**

6 VOLT DC RELAY
Small Size. Ideal for Mobile Use. SPDT
$0.99

PANEL METERS
NEW GOV'T SURPLUS STANDARD BRANDS
*Special Scale

2" METERS
0-100 MA* $2.45
0-10 MA AC 2.95
0-2 AMP RF 2.95
0-4 AMP RF 2.95
0-50 AMP AC 2.25
0-30 AMP DC 2.95

1" METERS
0-1 MA 4.95
0-2 MA 4.50
0-2.5 AMP RF 5.95
0-500 MA 4.50
0-100 VDC (1 MA) 5.95
0-200 VDC (1 MA) 5.95
0-250 VDC (1 MA) 5.95
0-750 VDC (1 MA) 5.95
0-150 VAC 6.95
0-300 VAC 6.95

FILTER CHOKES
10 Hy 175 MA $2.25
10 Hy 250 MA 2.75
10 Hy 350 MA 3.95
6 Hy 500 MA 4.95
6 Hy 400 MA (Rusty) 2.95

PIGTAIL MICAS
MMF: 0, 20, 50, 60, 100, 250, 300, 400, 500, 750, 1000, 2000, 3000, 4000, 5000, 6000, 10000 $0.09 ea.

Silver Mica Capacitors
MMF: 10, 50, 60, 340, 750, 780, 1000 $0.12 ea.

Non-Inductive Resistors
Ohms: 500, 12,500, 100 watts $0.75

FILAMENT TRANSFORMER
6.3 Volts at 10 Amps plus 5 Volts CT at 12 Amps. 3500 Volt Insulation. Primary: 115 Volt 60 Cy. Fully shielded. $2.99 ea.

MICROAMMETERS
3" METERS
0-30 UA $13.95
0-50 UA 10.95
0-200 UA 6.95
0-500 UA 5.95
4" METERS
0-200 UA 9.95

GE KV METER
0-15 KV DC. 3½" SQ. Bakelite case. 500 UA movement. Includes 30 Meg. 1% Ext. multiplier $12.75 ea.

2" GE Voltmeter
0-30 Volts DC Aircraft Type $4.60 $4.95

OIL CONDENSERS
3.75 mfd 660 vac $2.45
1.75 mfd 400 vdc 1.35
10 mfd 600 vdc 1.95
8+8 mfd 600 vdc 1.79
15 mfd 1000 vdc 4.95
1 mfd 1500 vdc .89
1.5 mfd 1500 vdc .95
4 mfd 1500 vac 2.75
1 mfd 2000 vdc 1.50
6 mfd 2000 vdc 3.95
8 mfd 2000 vdc 4.50
1 mfd 2500 vdc 2.25
1 mfd 3800 vdc 1.95
1 mfd 4000 vdc 2.95
2 mfd 5000 vdc 7.95
1 mfd 7500 vdc 1.95
.02 20,000 vdc 9.95
2 mfd & 8 RV DC 12.95
.5 mfd 25 RV DC 39.50

OIL CAPACITOR
1+1+1 MFD 1200 VDC SPECIAL 49c ea.

WESTINGHOUSE FREQUENCY METER
Type DY, 58 to 62 cycles. 3" Meter with external Reflector. $32.50

1% W. W. Resistors
Ohms: 2K-9500, 32K, 100K $0.35 ea.

BAKELITE CASED MICAS

MFD	VDC	Price	MFD	VDC	Price	MFD	VDC	Price
.001	600	$.10	.024	1500	$0.05	.001	5 KV	$1.60
.002	600	.24	.01	1500	.75	.002	5 KV	1.60
.01	600	.26	.02	2 RV	.90	.003	5 KV	1.90
.02	600	.28	.005	2500	.55	.003	5 KV	2.50
.01 1 KV		.45	.002	2500	.50	.001	6 KV	2.50
.002	1200	.35	.0001	5 KV	.70	.002	6 KV	2.90

WIRE WOUND RESISTORS
5 watt ohms: 25-50-84-200-2500 $0.09 ea.
10 watt ohms: 25-40-1125-2K-4K 15 ea.
20 watt ohms: 150-300-750-1K-1.5K, 2.5K, 2.7K, 10K, 20K .20 ea.
30 watt ohms: 100-2500-5100-18K .22 ea.
100 watt ohms: 100-1750-1500-2K, 10K, 15K, 20K, 100K .50 ea.

POWER SUPPLY KIT
1 UTC Power Transformer 700 VCT @ 90 ma., 5V @ 2A, 6.3V @ 1.2A
2 UTC 60 ma chokes. Transformer and chokes fully wired. Tested, and 2 Chokes. SPECIAL $3.95

ADJUSTABLE SLIDER RESISTORS
20 Watt: 1, 5 Ohms $0.25
50 Watt: 500 Ohms .39
75 Watt: 100, 150, 200 Ohms .59
100 Watt: 50, 1750 .69

MISCELLANEOUS BARGAINS
Ceramicons .000S mfd 7 for $0.49
.05 600V Oil Tubular 12 for .99
10K 15K Pots 4 for .99
A.-- Padder 50 MMF APC50 .39
.01 MFD, Moulded Paper Cond. 20 for .99

PEAK ELECTRONICS CO.
188 WASHINGTON ST., NEW YORK 7, N. Y.
Phone COrtlandt 7-6443-4

NEW TV PRODUCTS on the Market

ROTATOR ADAPTER KIT

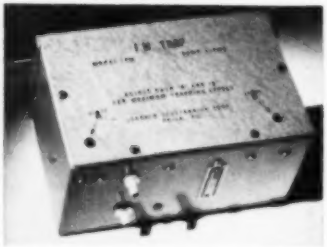
A new rotator adapter kit, designed to permit the installation of any commercial antenna rotator on its antenna towers, has been announced by *Alprodco Inc.*, Kempton, Indiana.

The adapter, which can be installed easily and quickly without special tools, consists of four matched components. These components include an adapter mounting plate, pre-drilled to accommodate any well-known rotator, upon which the rotator is mounted. This is placed within the framework of the tower itself. A ten-foot mast pole is provided to connect the antenna to the rotator, the pole being held securely within a 24 inch bearing, the third component in the kit. Finally, a three-piece mast kit is included which affords the necessary rigid support to keep the mast pole bearing in place.

Literature on this new kit is currently available from the company.

HIGH "Q" TRAPS

A new line of high "*Q*" traps, designed for use between the television receiver and its associated antenna to eliminate adjacent channel and FM interference, has been introduced by *Jerrold Electronics Corporation*, 26th and Dickinson Street, Philadelphia 46, Pa.



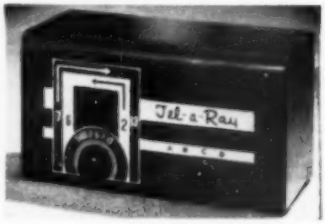
The traps are available in four models. The TLB covers Channels 2 through 6. The Model THB is designed to trap out adjacent channel interference on Channels 7 through 13. Interference from FM stations is trapped by using Model TFM, covering the range from 88 to 108 mc. The fourth unit has been designated as the Model "T Special" and is available on special order. It can be designed so as to eliminate interfering frequencies in any bands other than v.h.f. television and FM.

Full technical details are available on request.

SWITCHING BOOSTER

Tel-A-Ray Enterprises, Inc. of Henderson, Ky. has perfected an antenna switching booster which is capable of receiving signals from four antennas and can be switched from one to another.

Designed for fringe area reception where single-channel antennas perform better than multi-channel units, the new switching booster is equipped with four input terminals for four separate antennas, any one of which may be switched from the front. Four sets of terminals, supplying 6-7 volts a.c. for operation of up to four antenna-mounted preamplifiers, are mounted adjacent to the four input terminals and automatically switched as the antennas are switched.



A 6J6 preamplifier is an integral part of the switching booster and increases the strength of the signal as it arrives from the antenna. On occasions when the signal strength is naturally high, the preamplifier may be bypassed. The booster features an automatic switch which turns the booster on and off with the receiver.

ANTENNA ROTATOR

Viking Tool and Machine Corporation of Belleville, New Jersey has developed a new antenna rotator which is currently being delivered to the trade.

Powered by a simply designed impulse motor, the rotator assures full starting torque of 50 inch-pounds to give it maximum advantage in icy and adverse weather conditions.

Corrosion resistant materials are used throughout. The unit comes complete with a remote control box. An antenna direction indicator is available if desired.

CORONA INHIBITOR

The Receiving Tube Division of *Raytheon Manufacturing Company* has developed a line of picture tubes treated with the company's new "corona inhibitor."

Under certain atmospheric conditions, technicians have experienced difficulty with loss of picture brightness due to leakage, and arc-over from the second anode connector on the bulb of a television picture tube. This leakage from the second anode connection reduces the second anode volt-

age and, consequently, the brilliance of the picture. In addition, there may be audible effects from the corona. This difficulty has been experienced in varying degrees of intensity and in those cases where the leakage or corona has been slight, many valuable manhours have been lost tracking down the source of trouble.

According to the company, the new tubes treated with the "corona inhibitor" have this problem solved at the source. The company will supply additional details on these new tubes to those making their requests direct to the Receiving Tube Division at Newton, Massachusetts.

27" METAL TUBE

Rauland Corporation, 4245 North Knox Avenue, Chicago 41, Illinois is in production on a new 27" rectangular picture tube with an extremely short metal-coned envelope.

The new tube, known as the Type 27QP4, is a rectangular electrostatic focus, magnetic deflection, direct view tube. It is shorter from face to back than a standard 20" tube because of its 90 degree deflection design.

The screen of this new tube provides a picture area of approximately 390 square inches, about 40 square inches bigger than the center spread of a tabloid newspaper.

This tube can be used as a zero-voltage focus or can be focused to maximum sharpness with low voltage from the set's regular power supply. A single external magnetic field must be used in conjunction with the indicator ion trap to prevent ion spot blemish.

POWER RECTIFIER

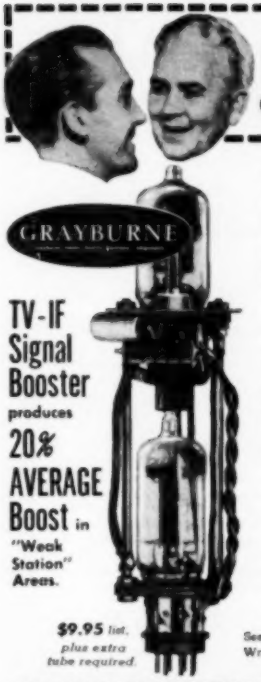
General Electric Company, Syracuse, New York has developed a new power rectifier for television receivers, radios, and military electronic equipment.

The new rectifier has been designated the G-10 germanium rectifier. The unit operates on the junction prin-



ciple and is designed to supply 350 ma. at normal television receiver plate voltages in a 55 degree centigrade ambient. It has a peak inverse voltage rating of 400 volts, with rectification efficiencies up to 98 per-cent.

The unit's small size and higher "B+" voltages are due to the extremely low internal losses. Its forward resistance at rated current is approximately 3 ohms and back resistance is about 1 megohm at −350 volts.



You don't use a 5-ton truck to haul 10 light bulbs! The same basic logic applies to TV boosters, too. In many "weak station" areas, in sets forced to use only indoor antennas, in RF-boosted sets still needing more gain—experience proves a **20% average** boost in overall signal is all that's needed to give satisfactory reception.

Model TSB-1 does exactly that—and **everything expected of an added stage of TV-IF**—at low cost, to complete customer satisfaction, at a handsome profit for you. It's well-designed and wired up in Adaptor form for easy installation. Only **one** wire to connect.

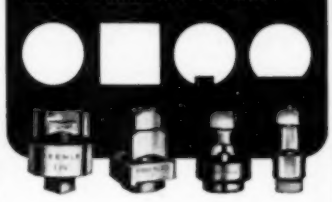
- **AMPLIFIES SIGNAL OVER 20% ON ALL CHANNELS**
- **INCREASES PICTURE BRIGHTNESS**
- **ELIMINATES OR MINIMIZES "SNOW"**
- **HAS ALL ADVANTAGES OF BROAD BAND BOOSTERS**
- **ELIMINATES SEPARATE TUNING FOR EACH CHANNEL**
- **NO SWITCHES OR EXTERNAL CONNECTIONS**
- **SIMPLE, PERMANENT, EASY INSTALLATION INSIDE CABINET**
- **EQUALS PERFORMANCE OF MANY HIGHER-PRICED BOOSTERS**

Specifications: 4" high, excluding tube. Min. Diam., bottom, ⅞". Max. Diam., top, 1⅛". Silver-plated contact pins. Draws only 0.3 amp. additional filament current from set's filament transformer. Individually boxed with complete instructions.

See the Grayburne TV-IF Booster at your favorite distributor today! Write now for complete catalog.

GRAYBURNE CORPORATION, 103 Lafayette St., New York 13, N. Y.

ROUND, SQUARE, KEY and "D" OPENINGS QUICKLY MADE with Greenlee Radio Chassis Punches





Save hours of hard, tedious work . . . cut accurate holes in chassis for sockets, plugs, controls, meters, panel lights, etc. with GREENLEE Punches. In 1-1/2 minutes or less make a smooth hole in metal, bakelite or hard rubber up to 1/16" thick. Easy to operate . . . simply turn with ordinary wrench. Wide range of sizes. Write for details. Greenlee Tool Co., 1883 Columbia Avenue, Rockford, Ill.

GREENLEE

NOW— Get this expert SELF-TRAINING in

RADIO SERVICING

by ABRAHAM MARCUS

(co-author of famous "Elements of Radio" which has sold over 800,000 copies!



Here is every detail you need to know about radio repair, replacement, and readjustment. Easy-to-understand, step-by-step self-training handbook shows you how to locate and remedy defects quickly.

Covers: TRF Receivers; Superheterodyne Receivers; Short-Wave Receivers and Converters; Multiband Receivers; Portable Receivers; Automobile Receivers; Communication Receivers; F-M Receivers; Power Supplies operated from AC, DC, Batteries, Motor-Generators, etc.

Tells you the HOW and WHY of **Electron Tubes** (Diode, Triode, Pentode, Beam Power, Thyratron, Phototube, Cathode Ray, etc.); **Rectifier Circuits** (Half-wave, Full-wave, Bridge, Voltage-Doubler, etc.), **Detector Circuits** (Diode, Triode, Regenerative, Superregenerative, Infinite-impedance, etc.); **Amplifier Circuits** (Audio, Radio, I-F, Video, D-C, etc.); **Oscillator Circuits** (Hartley, Colpitts, Crystal, Transitron, Multivibrator, Sweep-circuit, etc.), **Control Circuits** (Volume, AVC, DAVC, Tone, Noise-Suppression, Automatic Tuning, Automatic Frequency Control, etc.).

All in one big volume — easy to read. 16 Big Chapters, 424 Sections, 600 "Show-How" Diagrams, 775 pages of practical radio instruction.

Explains how to use **testing instruments** such as: meter, vacuum-tube voltmeters, ohmmeters, bridges, multimeters, signal generators, tube checkers, cathode-ray oscilloscopes, etc. Over 100 pages and 69 illustrations in this section alone!

Get this authoritative radio repair handbook today! Coupon below brings you "Radio Servicing" on FREE trial for 10 days. Mail it NOW.

PRENTICE-HALL, Inc., Dept. M-RW-352
70 Fifth Ave., New York 11, N. Y.

Send me, for 10 DAYS' FREE TRIAL, "Radio Servicing," by Abraham Marcus. I will return it in ten days and pay nothing—or keep it and send $1.95 down (plus postage) and $2 monthly for 2 months.

Name .....

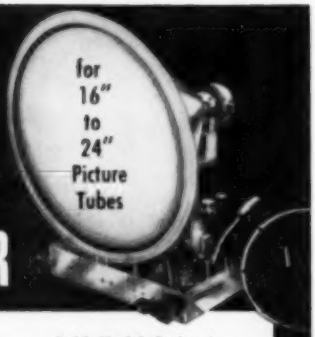
Address .....

City ..... State .....

( ) SAVE! Send $5.95 WITH COUPON—we pay postage.

3 New Custom-Built Deluxe TV Chassis for 16" to 24" Picture Tubes

by TECH-MASTER



MODEL 2430 – Designed specifically for all picture tubes requiring from 65 to 70 degrees horizontal deflection, (such as 24AP4, 20CP4, 19AP4, etc.) Supplied with quality PM speaker, and Universal Picture Tube Mounting Brackets & Phono Jack. $189.50

MODEL 2431P – Similar to model 2430, but with Push-Pull Audio, True Fidelity Output and Universal Picture Tube Mounting Brackets. $199.95

MODEL 2431C – Basically same as Model 2430 but with Continuous Tuner, Push-Pull Audio, True Fidelity Output and Universal Picture Tube Mounting Brackets. Allows complete coverage of both TV and F.M. bands. $199.95

The new **Gold Medal Series** incorporates all the latest Tech-Master features which have made this improved 630 type chassis the standard by which custom-built TV is measured . . . performance and service are assured because Tech-Master design and construction **are as fine as human hands and brains can produce.** All chassis are supplied completely wired, aligned and tested with all tubes (less picture tube).

LOOK for your Tech-Master registration and guarantee card attached to each chassis . . . it is your assurance that you are buying a genuine Tech-Master receiver.

See the Gold Medal Series and other quality Tech-Master products at your favorite Radio Parts Jobber or write direct to Tech-Master Products Co. Dept. RN-3, for complete descriptive literature.

TECH-MASTER PRODUCTS CO.
443-445 Broadway · New York 13, N. Y.

AMPERITE
Studio Microphones at P.A. Prices

Ideal for BROADCASTING RECORDING PUBLIC ADDRESS

"The ultimate in microphone quality," says Evan Rushing, sound engineer of the Hotel New Yorker.

- *Shout right into the new Amperite Microphone—or stand 2 feet away—reproduction is always perfect.*
- *Not affected by any climatic conditions.*
- *Guaranteed to withstand severe "knocking around."*



Models
RBLG—200 ohms
RBHG—Hi-imp.
List $42.00



"Kontak" Mikes
Model SKH, list $12.00
Model KKH, list $18.00

Special Offer: Write for Special Introductory Offer, and 4-page illustrated folder

AMPERITE Company, Inc.
561 BROADWAY • NEW YORK 12 N. Y.
Canada-Atlas Radio Corp. Ltd. 560 King St. W. Toronto

Amaze Yourself and Your Friends!
By Adding Pipe-Organ-Type Bass
to your present Amp. and Spkr. without muffling highs & middle

REVOLUTIONARY CIRCUIT INVENTION
only 4-resistors & 4-condensers

No. A25 Schematic & Data $2.00

DULL'S ELECTRICAL TRANSLATIONS
702 N. Bancroft Wilmington, Del.

BRAND NEW TUBES

OA2	$ 1.25	5JP1		$24.50	723A/B		$16.00
OD3 VR90	1.10	5JP2		24.50	724B		2.75
OD3 VR105	1.25	5R4GY		2.00	726A		5.95
OD3 VR150	.95	6AJ5		1.75	726B		39.50
1B22	2.95	6AM5		9.50	807		1.59
1B23	8.95	6SK7		2.95	810		9.50
1B24	12.50	6C21		27.50	813		8.50
1B27	17.95				829		9.95
1B38	25.95				829B		12.50
1N21B	3.50				832A		9.95
1N22	1.25				833A		45.00
1N23	1.49				836		3.78
1N23A	2.75				837		1.69
1N23B	4.98				838		2.95
1N43	1.40				860		3.95
1N54	.95				860A		5.95
1N55	3.75	6J6	$ 6.50		872A		2.75
1N56	.95	6J7	5.95		876		.98
1P22	5.25	7V7	1.15		884		1.75
2C39	29.50	10E	.98		931A		8.98
2C40	8.50	250B	8.95		955		.80
2C43	24.50	250TH	22.50		958A		.80
2C46	5.75	304TH	12.50		1616		.69
2D21	1.49	304TL	9.95		1626		1.50
2E30	1.98	307A	3.95		1625		.45
2K25	32.50	703A	4.95		1632		.69
2K39	99.50	703A	4.95		1644		.80
3B24	4.50	707B	14.95		2051		1.50
3C23	8.85	713A	.98		5654		4.50
3C31	12.50	715B	8.98		5670		4.95
3E29	11.95	715C	32.50		5694		1.25
4C35	34.50	717A	1.39		5703		2.10
4E27	26.50				5726		4.95
4X150A	39.00				5781		4.25
4X500A	95.00				5814		4.50
5BP1	4.95				5861		7.00
5BP4	4.50				9001		1.75
5D21	22.50				9002		1.50
5GP1	4.50				9003		1.75

YOUR SURPLUS WANTED! We Pay Highest Prices!

Vacuum Capacitors
50-15 . $ 9.95
12-20 . 6.98
50-12 . 12.98

Complete Line of Transmitting & Receiving Tubes.
Send Cash With Order and Save C.O.D. Charges!

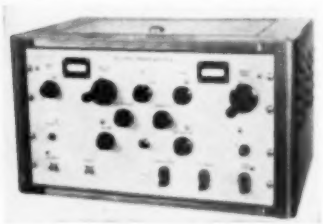
J. S. H. SALES CO.
Dept. B-10, 7582 Melrose Ave., Los Angeles 46, Calif.

Complete engineering details on the G-10 are available from the company together with information on other smaller units with lower voltage and power ratings.

U.H.F. SWEEP GENERATORS

The Tube Department of *Radio Corporation of America*, Harrison, N. J. has recently introduced two new u.h.f. sweep generators, the WR-40A and the WR-41A.

Both instruments feature continuous tuning from 470 to 890 mc. and operation is entirely on fundamental frequencies—no beat notes or harmonics



are used. They have a continuously variable sweep width from 0 to 45 mc. with an amplitude variation of .1 db per mc. or less throughout the swept range. The maximum output level of the sweep oscillator is .5 volt across a 50 ohm load. Facilities are also provided for matching to either a 72 or 300 ohm load.

The WR-40A is a laboratory-type instrument while the WR-41A is suitable for factory operations. Data sheets providing complete details on both of these units are available from the company.

TWO-SET COUPLER

A television coupler which permits the operation of two receivers from a single antenna is now being marketed by *Radio Merchandise Sales, Inc.*, 1165 Southern Blvd., New York 59, New York.

The unit has been designed to meet the requirements of two-set families or those living in apartment buildings or multi-family houses. Through this coupler, simultaneous reception on both sets is possible without interference from either set. Equal signals are provided to each set from the coupler which the company claims will reduce local oscillator radiation from the receiver and minimize incoming interference.

The coupler can be simply and quickly installed on the wall baseboard or other convenient location, at distances permitting the shortest leads to the receivers.

Literature on the coupler is available from the company on request.

FRINGE AREA ANTENNA

The latest addition to its line of fringe area TV antennas, the "Radarray" Model C, has been announced by the *Gonset Company*, 72 E. Tujunga Ave., Burbank, California.

This array is designed to give a clean

directivity pattern with high front-to-back ratio, a good impedance match, and high gain on all channels. The gain and front-to-back ratio are greatest on the high channels although it is good on the low channels too.

Through the use of large diameter dipoles and an 8 foot non-resonant reflector screen, it is possible to obtain broadband characteristics greatly superior to those obtainable with conventional dipoles and resonant reflector elements.

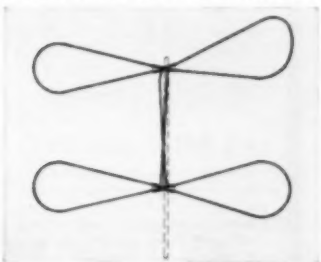
On the high band the array functions as four half-wave dipoles in phase, spaced ¾ wave ahead of the reflector screen. On the low band, shorted stubs across the dipole elements lower the fundamental resonant frequency and at the same time provide a good impedance match on the low channel. These stubs are quarter-wave resonant on the high band and thus have negligible effect on high-band operation.

"CLOVER-V-BEAM"

Telrex, Inc. of Asbury Park, New Jersey is currently making deliveries on its new and improved "Clover-V-Beam" antenna.

The new array is compactly folded, completely preassembled, and can be speedily rigged by tightening two nuts. Performance of this new unit is attributed to the company's unique application of transposed co-linear elements in conjunction with stacked closed loop "Conical-V-Beam" dipoles. In operation the interconnecting rods load the dipoles for low frequency channels and serve as transposed half-wave transformers at the high channels. This provides the sensitivity of resonant closed loop conical dipoles at the low frequencies and long wire "V-Beam" operation at the high channels.

The "Clover-V-Beam" weighs less than 24 ounces and has a lateral displacement under 5 feet, thus offering negligible wind resistance, minimum ice loading, and small down thrust.



Application data on this antenna is available upon request to the Engineering Dept. of the company.

NEW TV COMPONENTS

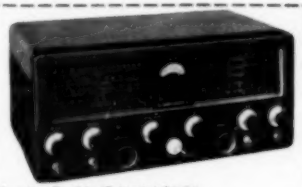
Standard Transformer Corporation, 3580 Elston Avenue, Chicago, Illinois has announced the availability of two new television components—a high efficiency deflection yoke and a high voltage flyback transformer.

Deflection yoke DY-10 and horizontal output and high voltage trans-



What Do You Want to Trade In on a New hallicrafters?

I have a complete stock of Hallicrafters receivers and transmitters. We will give you the best doggone trade-in in the world because we need used receivers badly for our trade. What do you have? Write me about it. I give you prompt delivery, 90-day FREE service and the world's lowest credit terms. Write, wire, phone, or visit either store today for the best deal. Export orders solicited. Bob Henry W9ARA



Popular Double-IF Model SX-71
A double superheterodyne circuit receiver at modest cost. Built-in narrow band FM reception. Temperature compensated, voltage regulated. 5 position band selector for 538-1650 kc, 1600-4800 kc, 4.6-13.5 mc, 12.5-35 mc, 46-56 mc. 11 tubes plus voltage regulator and rectifier. Only $199.50



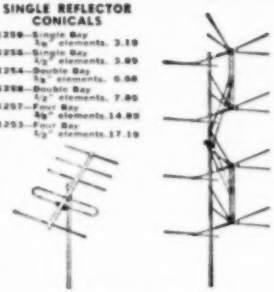
All-Wave Receiver Model SX-62
Covers 540 kc to 109 mc—including AM, FM, and SW broadcasts. Six bands: 540-1620 kc, 1620 kc-4.9mc, 4.9 mc-15 mc, 15-32 mc, 27-56 mc (AM-FM), 54-109 mc (AM-FM). Only $289.50. Other popular Hallicrafters models: S-76, $169.50; S-40B, $99.95; S-72, $109.95; S-72L, $119.95; S-81, $49.50; S-82, $49.50.

HENRY RADIO STORES
WORLD'S LARGEST DISTRIBUTORS OF SHORT WAVE RECEIVERS

TEVCO

SINGLE REFLECTOR CONICALS

1259—Single Bay ½" elements. 3.19
1258—Single Bay ⅝" elements. 3.89
1254—Double Bay ½" elements. 6.68
1258—Double Bay ⅝" elements. 7.80
1257—Four Bay ⅝" elements. 14.80
1253—Four Bay ½" elements. 17.19



FIVE ELEMENT YAGI BEAMS

2002 to 2006—any tv channel 2.69
2007 to 2013—any tv channel 3.19

1236—Single Bay Twin-V 3.76
1237—Double Bay Twin-V 7.49
1234—Four Bay Conical 16.99
1238—Double Bay Conical 7.80
1243—Swift Rig Folded Hi Folded Low 3.89
1240—Single section conical—lots of 5 ..... 1.00
1244—Swift Rig Folded Hi Straight Low 3.49
2113—Deluxe Indoor Antenna 1.99
1866—Chimney Mount ..... Dozen Lots 1.19
1905—3½" Mast Snap-On Standoff ..... Per 100 5.60
1873—3½" Mast Standoff Insulator ..... Per 100 3.50
1872—4" Nail-in Insulator ..... Lots of 50 .02
1870—3½" Wood Screw-Eye Insulator Lots of 50 .02
1229—Single Bay Conical 3.75
1861—5 Ft. 1¼" Diam. Galv. Steel Mast ..... .82

Send for quantity prices and complete list

TELEVISION SUPPLY CO.
Box 13 Greenpoint Station Brooklyn, N. Y.

NEW! MOSLEY ROOF-THRU



The Leak-Proof Roof Entrance for TV and FM Transmission Line and Rotator Control Cable

Here's the new ROOF-THRU, another MOSLEY product for BETTER TV PICTURES Through More Efficient Installation. ROOF-THRU provides the easiest and most practical method of bringing in lead-in for concealed-in-wall installations using MOSLEY Flush Mounted Sockets.

Why the ROOF-THRU Way Is Best:

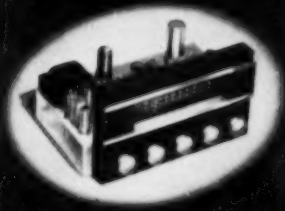
- Permits shorter lead-in line resulting in less loss of signal energy—less interference pick-up!
- Copper flashing and plastic bushing provides perfect seal against leaks!
- Prolongs life of transmission line by keeping it out of weather!
- Eliminates unsightly wires on outside of house!
- Long lasting—weather can't hurt ROOF-THRU!
- Easy to install on new or old buildings!

Cat. No. 624 MOSLEY ROOF-THRU.
List Price.....$5.84

See the ROOF-THRU and MOSLEY Flush Sockets at your jobber.

MOSLEY ELECTRONICS
2125 Lockland Road, Overland, Missouri

this is it—
this is the tuner
you designed!



the
craftsmen 10

High Fidelity
FM-AM Tuner

Maybe you had a hand in designing this magnificent tuner. A lot of our friends did. Their questions and suggestions made sense because they came from people who knew what they needed. The superior flexibility and performance of the C-10 proves it. And we think it will answer your rigid requirements, too.

- *Two cathode followers furnish both audio output and detector output for remote installations.*
- *Built-in pre-amplifier, compensated for variable reluctance pick-ups.*
- *Automatic Frequency Control entirely eliminates drift, simplifies tuning.*
- *5 microvolts sensitivity on both FM and AM.*
- *10 kc filter on AM eliminates interstation squeal.*
- *Bass and treble tone controls for boost, cut, or 20—20,000 cycle flat response.*

Write for information—or send 50c for instructions and schematics

THE RADIO craftsmen INC.
Dept. R-3, 4401 N. Ravenswood Ave., Chicago 40, Ill.

former A-8131 are companion units designed to be used in direct drive circuits. The two new components have extensive applications and are exact replacements in thirty-four *RCA* television models, thirty *Emerson* models, and seven *Capehart* models.

The DY-10 is an anti-astigmatic yoke with cosine windings and nylon



insulation, designed to provide a sharp, well-focused picture over the entire CR tube.

Specifications and a complete list of TV models for which these components are exact replacements are contained in *Stancor* Bulletin 389 which is currently available.

TUBE AND TOOL CASE

Television Engineers, Inc., 1539 W. Harrison Street, Chicago is currently offering a new "Vis-U-All" tube and tool case that meets the requirement for a compact unit to hold all tubes and tools ordinarily required for home TV service work.

The new case will accommodate 45 miniature, 44 GT, and 18 large tubes—a total of 107 tubes or all tubes used in a postwar television receiver. It holds tubes snugly and protects them against breakage.

Made of strong plywood covered with durable leatherette, the new case measures 16 x 13½ x 7½ inches when closed and weighs only 7½ pounds. Fully loaded it weighs only slightly more than 20 pounds. A 15½ x 3 x 2½ inch compartment, with snap lock door, accommodates all tools ordinarily needed for home service work.

TV TOWER LINE

Tele-Ex-Pand Products Sales Corp., Berwick National Bank Bldg., Berwick, Pa., is currently marketing a new line of television towers and accessories designed for home television installations, as probe towers, as community towers, and ham antenna masts.

Deluxe, standard, and economy models are available at the present time in addition to the necessary base plates, mast mounts, and tower tops.

All of the towers are constructed of 1", electrically welded, tubular steel and have 1¼" x ⅛" cross bracing. All of the units have an all-weather aluminum finish.

Data sheets on these towers and the company's line of tower accessories are available on request.

—30—

SENSATIONAL VALUE!

630 SUPER 30 TUBE CHASSIS
Mfr. Licensed under R. C. A. Patents

Complete with 21" first quality tube AND Beautiful hand-rubbed Mahogany Console Cabinet.
COMPLETE PRICE
$259.95
slightly higher with full doors



the latest 1952 model with all the newest electronic improvements . . .

- peak sensitivity for fringe areas
- synchrolock tuning
- keyed A G C
- 15,000 volts under load
- 12-inch RCA speaker
- can be adapted to color & UHF
- high quality parts

A set—NOT A KIT

Completely wired, Factory Engineered, aligned and tested. RMA Guaranteed

1 YEAR GUARANTEE ON TUBE

A half-hour to mount; ready for operation. Saves up to $150.

Compare this anywhere for high quality—low price!

Write Dept. F for further information. Phone and mail orders filled on receipt of money order for 25% as deposit . . . the balance C.O.D., f.o.b. N. Y.

NEW ENGLAND TELEVISION CORP.
75 CHURCH STREET NEW YORK, N. Y.

South River
★★NEWS★★



EAVE MOUNT Model EM-1

Heavy gauge steel, embossed for extra strength, rustproof, hot-dip galvanized finish. Upper bracket provides 4" clearance from eave; lower bracket, generous 48" spread. Complete with hardware.

South River Antenna Mounting Accessories are carried by every leading TV Parts Jobber from coast to coast.

New catalog mailed to all Dealers and Service Men. Write, if you haven't received yours!

SOUTH RIVER METAL PRODUCTS CO., INC.
SOUTH RIVER, N. J.

PIONEER AND OUTSTANDING PRODUCER OF FINEST LINE OF ANTENNA MOUNTS

Loudness Control

(*Continued from page 39*)

of the holes is not critical, but should be at least $\frac{1}{16}$ inch, and preferably $\frac{3}{32}$ inch.

Remove the cover from the potentiometer and, using an ohmmeter, find the 200,000 ohm points. Make a scribe mark at these points, which are to connect to the taps. To make contact with the resistance element at these points, a scribe or fine pen point and a small amount of air drying silver paint are necessary. Apply the paint to the edge of the resistance element at each of the 200,000 ohm marks, and draw a fine line of the paint from each mark to the corresponding hole drilled in the edge of the base. The paint must be applied sparingly to the resistance element so that it will not interfere with movement of the rotor brush, and it cannot be allowed to run over the edge of the base except directly opposite the terminal hole, because a contact with the cover will ground the potentiometer and short circuit a portion of the network. Get as much of the paint as possible into each of the holes, and dip the ends of the contact wires in the paint before inserting them into the holes.

If properly done, the paint itself should hold the wires quite firmly in place. However, don't expect the paint to hold until it has completely dried. This may take several hours, but may be speeded up by baking with an infrared heat lamp.

File notches in the edge of the cover at appropriate points to clear the ribbons of silver paint where they cross the edge of the base to the terminal wires. It is necessary that this be done because the cover must be replaced to provide the stops for the potentiometer.

All the other components of the compensating network as shown in Fig. 3 may be mounted on a small resistor board, or, if the components used are quite small, they may be mounted directly on the terminal wires as was done in the unit shown in the photograph. A shield for the complete unit may be made from a coil shield can or, for that matter, from a small empty tin.

Adjust the variable trimmer condenser only after the complete unit is installed. The effects of wiring capacitance may influence this adjustment greatly, and should be taken into account. The adjustment may be made either by measurements, or simply by listening tests. If the amplifier and speaker system to be used are capable of reasonably uniform response from 40 to 10,000 cycles or better, about 8 db of compensation at 10,000 cycles is adequate when the "Loudness Control" is set for minimum output.

However, if the amplifier or speaker does not have sufficient response below about 50 cycles, the "Loudness Control" may produce an objectionable resonance effect at low levels. In this

WORLD'S FASTEST SELLING VOLT-OHM MILLIAMMETER



Sensitivity 1000 ohms per volt

★ Uses latest design 2% accurate 1 Mil. D'Arsonval type meter.

★ Same zero adjustment holds for both resistance ranges. It is not necessary to readjust when switching from one resistance range to another. This is an important time-saving feature never before included in a V.O.M. in this price range.

★ Housed in round-cornered, molded case.

★ Beautiful black etched panel. Depressed letters filled with permanent white, insures long-life even with constant use.

The Model 770 comes complete with self-contained batteries, test leads and all operating instructions. **$14.90 NET**

Specifications:
6 A.C. VOLTAGE RANGES: 0–15/30/150/300/1500/3000 Volts.
6 D.C. VOLTAGE RANGES: 0–7.5/15/75/150/750/1500 Volts.
4 D.C. CURRENT RANGES: 0–1.5/15/150 MA. 0–1.5 Amps.
2 RESISTANCE RANGES: 0–300 Ohms 0–1 Megohm.

Model 770 is an accurate pocket-size V.O.M. Measures only 3¼" x 5⅝" x 2¼".

Write Dept. BN-3 for catalog of complete line.

AT YOUR RADIO PARTS JOBBER

SIC Manufactured and Guaranteed by SUPERIOR INSTRUMENTS CO. 227 Fulton Street • New York 7, N. Y.

Leotone RADIO CORP. 67 Day Street, New York 7, N. Y.

POWERFUL !!! ALNICO MAGNETS !!!

ALNICO MAGNET KIT ... Write for Latest "Alnico" Supplement!

LEARN Television-Radio Electricity REFRIGERATION-ELECTRONICS IN THE GREAT SHOPS OF COYNE

TRAIN QUICKLY! OLDEST, BEST EQUIPPED SCHOOL of ITS KIND in U.S.

Young and Older Men . . . .

Come to the Great Shops of Coyne in Chicago. Get practical training in TELEVISION-RADIO or ELECTRICITY—vital in Defense Program. Prepare now for a better job or better service rating.

START NOW—PAY LATER

You can finance most of your tuition, pay for it later in easy monthly payments. Special plan for men of Draft Age. Part time employment service available.

FREE BOOK Clip coupon for Big Free Illustrated Book. Indicate below, course that interests you. No salesman will call. Act NOW.

COYNE SCHOOL H. W. Cooke, President A TECHNICAL TRADE INSTITUTE, CHARTERED NOT FOR PROFIT Established 1899 500 S. Paulina, Chicago

ELECTRICITY ★ TELEVISION RADIO ★ REFRIGERATION ★ ELECTRONICS

H. W. COOKE, Pres., COYNE School 500 S. Paulina St., Chicago 12, Ill. Dept. 32-85H

Send FREE BOOK and full details on: ☐ TELEVISION-RADIO ☐ ELECTRICITY

NAME .....

ADDRESS .....

CITY ..... STATE .....

Sensational TV BARGAINS!



Rocket YAGI

5 ELEMENT TV ANTENNA

Excellent Pictures in Fringe Areas

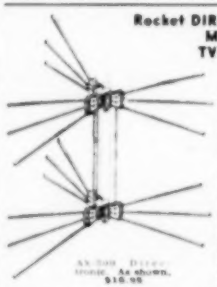
HIGH GAIN. Clearer, sharper, steadier pictures. PERFECT PICTURES IN FRINGE AREAS. Minimum interference from ghosts and noise due to a directive pattern. Five elements, carefully tuned and spaced, three directors, one reflector, coupled boom to mast. MATCHES 300 OHMS IMPEDANCE. Molded insulator provides additional strength. Exclusive design and construction prevents moisture forming or collecting under any conditions. STUBBY, TROUBLE-FREE, LONGLIFE. THIN WALL rolls. No broken elements. Stands the test of several weather. Elements of extra heavy aluminum clamped top and bottom. QUICK, EASY, completely pre-assembled. Just swing elements into line and tighten wing nuts. Simple . . . quick . . . easy. Available for any channel, high or low band.

Channels 2 and 3 **$7.95** each | Channels 4, 5, and 6 **$6.95** each | Channels 7 to 13 **$3.95** each

EACH CHANNEL requires a DIFFERENT Yagi. When ordering specify exact Channel number desired.

SOLD ONLY BY MAIL BY NATIONAL ELECTRONICS

Rocket DIRECTRONIC MOTORLESS TV ANTENNA



360° Electronically Switched Beam

- No Motors
- No Roof Orientation
- No Electric Power
- No Ghosts

The Directronic 18 element, 360° antenna is the finest for ultra-fringe or metropolitan reception. The RF PAT molded insulator is a marvel of electrical and mechanical perfection. Frame resists weather or temperature, either mechanically or electrically. Included in the AX-500 "Directronic" Array are:

18 tri-tensile aluminum alloy elements
1 set of connecting slabs
1 universal U clamps for masts to 1½"
Directronic Beam Selector
75 feet of TV-X Cable
1 stacked array per carton

AX-50 Directronic, 6 element Single . . . . . $ 9.50
AX-500 Directronic, 12 element Stacked 14.25
AX-50 Directronic, 9 element Single 10.50
All above antennas include TV-X Cable and Switch.

AX-500 Directronic, 18 element Stacked . . . . . As shown, $18.95

SOLD ONLY BY MAIL BY NATIONAL ELECTRONICS

Rocket ALL CHANNEL CONICALS



This sturdy, all-aluminum constructed TV antenna is designed for broad-band reception on all TV channels, plus FM. High gain, 6 to 1 front-to-back ratio. All channels 2-13. Uni-Directional. Maximum signal to noise ratio. For use with 72 to 300 ohm transmission line. Complete with all hardware—less mast.

Single Bay . . . . . $3.75 each
Stacked Array with Tie Rods . . . . . $8.20 each

SOLD ONLY BY MAIL BY NATIONAL ELECTRONICS

1¼" O.D. Mast (Dualcoiled) 5' crimped	$1.05
Mast Steel (Dualcoiled) 10'	$1.95
Mast Steel (Zinc plated) 10'	$1.50
Mast Connectors for 1¼" O.D. Mast—10" long	49c
3 Conductor Motor Wire	3c ft.
4 Conductor Motor Wire	4c ft.
Peak Roof Saddles (Will take up to 1¼" O.D. Mast)	$1.49
Twin Lead 300 Ohm—#20 Mil-Spec	2½c ft.
Twin Lead 300 Ohm—#16 Mil-T 28 Stranded	3c ft.
Double Stacking Assembly for stacking 2 TX Arrays	$1.70 set
Aluminum Tool Line ⅞"-18—Stranded—300 ft coil	$4.95
Antenna TV Lightning Arrestor	89c
Chimney Mount—Complete with Straps	$1.10
Cork—4 Hole	6½c ea.
Guy Wire—Galvanized—4 strand #20	2c ft.
Guy Wire—Galvanized—6 strand #20	3c ft.
Guy Wire—Galvanized—11 strand #20	11c ft.
Insulators Anchor—101-T3	$22.50
Transformer	$26.97
Standoff screw Insulators—3" for 300 Ohm	$2.75 C
Standoff Screw Insulators—3" for 300 Ohm	$5.50 C
Twin Lead Entrance Insulator	$8.50 C

PRICES SUBJECT TO CHANGE WITHOUT NOTICE
ALL PRICES F.O.B. CLEVELAND, OHIO

Be not remit more than complete purchase price. Pay postage charges on receipt of goods. 25% Deposit on C.O.D. orders, please. Money Back guarantee.

National Electronics
OF CLEVELAND
THE HOUSE OF TV VALUES
103 Dolsa Building • Cleveland 3, Ohio

case, additional compensation at the high frequencies can be used to advantage by producing a similar resonance effect. The combination of the two will be much more listenable than with either one alone.

Since definite rules cannot be stated which will cover all cases, it may be best to make the final adjustment of the trimmer while listening to a high quality recording at a very low level. Both the high and low frequencies should have a natural sound.

You will be very pleasantly surprised at the results obtainable with the "Loudness Control." If you are one of those people who "just don't like the highs" be prepared to change your mind. Chances are, you just haven't heard a full range system which takes into account the peculiarities of the human ear.

This "Loudness Control" has brought forth many unsolicited compliments from people who are neither electronic nor musical experts. It is no longer necessary to disturb the neighbors with over-loud music, since an appreciation of the full tonal range can now be had at any volume level.

REFERENCES

[1] *Fletcher, H., and Munson, W. A.; "Loudness, its Definition, Measurement, and Calculation," Jour. Acous. Soc. Amer., p. 82, October, 1933.*

[2] *Romberger, D. C.; "Loudness Control for Reproducing Systems," Audio Engineering, p. 11, May, 1958.*

[3] *Winslow, J.; "Full Range Loudness Control," Audio Engineering, p. 24, February, 1949.*

[4] *Turner, J. W.; "Construction Details of a Continuously Variable Loudness Control," Audio Engineering, p. 17, October, 1949.*

—30—

RESISTOR PROTECTION

By MILTON WHITE

A COPPER alligator clip placed on the lead between a composition resistor and the soldering iron as shown in the photograph, will act as a thermal shunt, protecting the resistor against the damage often caused by the heat of the soldering operation. This protection is important where very short resistor lead lengths are required, since under this condition, the heat will not be radiated by the lead quickly enough to prevent the resistor from reaching a temperature where a permanent change in its value may occur. —30—

Method of dissipating heat and protecting resistor when soldering in close quarters.



WANTED WE NEED YOUR Surplus Electronic Equipment!

WE PAY TOP $$$ FOR:

Radio Receivers	An Connectors
Transmitters	Clamps
ARC-1	Plugs
ARC-3	Cords
ART-13	Relays
Control Boxes	Telephone Materials
Indicators	WE BUY ANYTHING!!

WRITE, WIRE TODAY!
TELL US WHAT YOU HAVE
TALLEN COMPANY, INC.
Dept. RN, 159 Carlton Ave.
Brooklyn 5, N. Y.

SCARCE IMMEDIATE DELIVERY
RADIO and TV TUBES

COMPLETE LINE OF
Television Picture Tubes

Radio and TV service men, experimenters, amateurs . . . we have many types of scarce tubes ready for immediate shipment. Don't use make-shifts or spend valuable time looking for tube sources. Try Electro FIRST . . . and get the tubes you need without delay. Get complete list and Electro's low prices. It's FREE . . . write today!

TUBES BOUGHT, SOLD and TRADED
Send Your Want and Trade List!

ELECTRO-SALES 426 W. Randolph St., Chicago 6, Ill.

SCHEMATICS—CONVERSIONS FOR SURPLUS GEAR
NEW LIST! MANY ADDITIONS!
Send stamped, self addressed envelope for List R. Add 25c for chart explaining AN nomenclature.
R. E. GOODHEART — BOX 1220 BEVERLY HILLS, CAL.

KITS RADIOS 1 2 & 3 band Electric and/or battery **KITS**
TELEVISION AC/DC Operated
TEST INSTRUMENTS
Write for FREE Catalog
ARKAY—Radio Kits, Inc.
120 Cedar St. New York 6, N. Y.

AN/APR-4 COMPONENTS WANTED

In any condition. Also top prices for: ARC-1, ARC-3, APR-1, APR-5A, etc.; TS-34 and other "TS-" and standard Lab Test equipment, especially for the MICROWAVE REGION; ART-13, BC-348, BC-221, LAE, LAF, LAG, and other quality Surplus equipment; also quantity Spares, tubes, plugs and cable.

ENGINEERING ASSOCIATES
432 Patterson Road — Dayton 9, Ohio

RADIO ENGINEERING DEGREE IN 27 MONTHS

Radio engineering is a big field. There's room for you in it—if you're good. Get first-class training at Indiana Tech. Intensive specialized course, including strong basis in mathematics and electrical engineering, advanced radio theory and design, fine TV and Electronics. Modern laboratories. Low tuition. Also 27 month courses in Aeronautical, Chemical, Civil, Electrical and Mechanical Engineering. Approved for G.I.'s. Enter March, June, September, December. You can earn part of your expenses right here in Fort Wayne while you are studying.

INDIANA TECHNICAL COLLEGE
932 E. Washington Blvd. Fort Wayne 2, Indiana
Please send me free information on B.S. Engineering Degree in 27 months as checked.
☐ Radio-Television ☐ Aeronautical
☐ Civil ☐ Mechanical ☐ Electrical
Name .....
Address .....

The "Codetyper"

(Continued from page 47)

output, its input grid receives a pulse from the "phantom switch network." This positive-going pulse overcomes the bias which is holding the tube to cut-off because of the large value of the cathode resistance. Plate current starts to flow through a plate resistor and the voltage at the plate drops. This negative-going pulse is coupled to a second section of the tube through a condenser and causes the second half of the tube to become biased to cut-off. When this happens, the rise in plate voltage across the load resistor initiates a positive-going pulse which is then fed to the keyer.

At the same time the square wave which appears across the cathode of the first UIG common bias resistor is taken off and differentiated. This differentiated voltage has two pips on it—a negative-going one which corresponds to the leading edge of the pulse and a positive-going one which corresponds to the trailing edge. The negative pip has no effect on UIG #2 but the positive-going pulse causes UIG #2 to trigger, thereby setting up the same conditions on UIG #2 as previously existed on UIG #1. This pulse follows at the exact moment that UIG #1 has completed its pulse to the keyer tube.

The speed of the interval or the timing thereof is governed by the size of the coupling condenser and resistor and other circuit parameters. In addition, there has to be some method of varying the pulse width depending on the code speed desired. A simple system has been devised whereby all 19 UIG's are controlled by the same potentiometer. This is accomplished by allowing the coupling condensers to discharge up to "B+" rather than down to ground as is usually the case. All grid resistors are, therefore, returned to a common "B+" point. By setting a reference voltage against this common "B+" point, the potential differences across all coupling condensers can be controlled. By varying this voltage, the timing rate of all 19 UIG's can be varied simultaneously.

As the pulse follows down through the chain each UIG is successively triggered and each triggers a keyer in sequence. If UIG #1 is triggered, 19 pulses are formed in the chain, however, the keyers are arranged in such a way that they form the various marking and spacing intervals as will be described.

Keyer Operation

All of the keyers connected to the even-numbered UIG's are, in addition to being biased to cut-off, gated off at the same time. The gating takes the form of a removal of the plate voltage from the keyers. All of the odd-numbered keyer plates are returned directly to "B+" while the even-numbered keyers have their plates re-

Let MILTON S. KIVER Help You Prepare For U.H.F.-TV And...

TELEVISION SERVICING



Easy to TRAIN AT HOME This Practical Way!

Men with the right training in Television Servicing are in big demand . . . pull down big pay. T.C.I. TRAINS YOU RIGHT with easy-to-follow technical training designed *by* servicemen, *for* servicemen! You learn practical, professional type Television Servicing without leaving your present job. Included are money-making extras such as set conversion, master antenna installation, U.H.F.-TV and field servicing short cuts. You can start earning Television money after the first few lessons. You learn to test, trouble shoot and repair all types of TV sets the proven, *practical* way!

HERE'S HOW YOU GET EXPERIENCE!

You train on your own large screen modern television receiver, furnished as part of your course. This set is yours to keep! As an optional feature you can get two weeks of actual field experience out on service jobs and on the repair bench for Chicago's largest independent servicing organization. You learn Television Servicing by *actually doing* Television Servicing . . . you get the *practical* know-how you need to qualify for BIG MONEY in this fast-growing field! **Age is no barrier. Many TCI students are over 40!**

ACT NOW! Fill out and mail coupon for FREE Catalog and SAMPLE LESSON. Write TODAY!

TELEVISION COMMUNICATIONS INSTITUTE
205 W. Wacker Dr., Dept. 1-U Chicago 6, Ill.

YOU GET and keep modern large screen Television receiver.
YOU DO actual testing, servicing, trouble shooting and repairing

TV BROADCASTING COURSE READY NOW!
Train at home for these big pay studio jobs! Video engineers, cameramen, microwave engineers, etc. Easy non-mathematical training covers all phases. Write!

MAIL NOW FOR FREE BOOKLET

MILTON S. KIVER, President
TELEVISION COMMUNICATIONS INSTITUTE
205 W. Wacker Dr., Dept. 1-U, Chicago 6, Ill.
Rush full facts on the course checked below. I am not obligated. Salesman will not call.
( ) TV Servicing ( ) TV Broadcasting
Name Age
Address
City Zone State
( ) BEGINNERS check here for information on Pre-Tel Radio Course

We Want . . .

Radcom pays highest prices for surplus equipment, parts and tubes. We need:

- TCS-6 & up Trans Receivers
- 12 Volt TCS Power Supply
- BC-312, 342, 348 Receivers
- BC221 Frequency Meters
- Test Equipment
- SCR-508, SCR-608
- Tubes; Rectifiers RA-34

WHAT DO YOU NEED?

Radcom deals in radar, sonar, high and low power transmitters; navigational aids; all types of marine and airborne equipment.

Inquiries Invited!
Complete Export Facilities

RADCOM ENGINEERING CO.
8 Livingston Street
Newark 3, N. J.

YOU CAN BUY
PICTURE TUBES
(magnetic deflection types only)
WITH A ONE YEAR GUARANTEE
for
$ 1.30 PER INCH

Tubes smaller than 12" @ $15.60 minimum.
Add $1.50 per tube for all metal tubes

Send us your dud picture tubes. We will return them *completely* factory rebuilt with *all scratches removed, new gun, coatings and screen* and guarantee them for 1 year. Broken neck tubes must have at least 2" of neck. Send them prepaid, packed securely and insured. Include full payment with order and we will ship in 48 hours. Otherwise allow 1 week C. O. D. All shipments collect.

EXAMPLE: 16" TUBE X $1.30 = $20.80
if metal tube add 1.50

PACKING? Send a $2.00 deposit and we'll send you a shipping carton. Deposit will apply to order. Be sure to include tube type and size.

DEALERS: Save money—don't hang on to duds—turn them into new stock.

VACTRON
398 ASHFORD AVE., DOBBS FERRY, N. Y.

turned to one of the "sequence selectors." This means that unless a particular "sequence selector" is turned on, all of the even-numbered keyers will be unable to deliver pulses to the keying relay. Thus any pulse starting at the beginning of the chain and traveling down to the end activates the keying relay on every other pulse only, producing 10 dot marking intervals separated by 9 space intervals.

Since every other keyer is gated to cut-off a string of dots is formed. Should dashes be required in the transmission of the character it becomes necessary to activate one or more of the keyers that were gated off.

It is possible to send any number of units by entering the UIG chain at any point. Every even-numbered UIG has a cathode connection running to the "phantom switch network." This cathode connection on the even-numbered UIG is used to trigger the odd-numbered UIG immediately following. This is done by the simple expedient of putting a positive pulse across the cathode resistor of the UIG preceding the one to be triggered. For example, in sending the letter "S" which would use UIG's #19, #17, and #15 for dots and UIG's #16 and #18 for spaces, it would be necessary to start by triggering UIG #15. To do this the "phantom switch network" would have to deliver a pulse to the cathode of UIG #14 because its keyer is normally gated, which would cause the keyer connected to UIG #15 to be pulsed, operating the relay. This would provide three dots separated by two spaces. If a character consisting of more than three dots was desired, it would be necessary to go down the chain to UIG #12 or back to UIG #10, #8, #6, #4, #2, or #1 or the end of the chain. In this way it is possible to obtain any number of pulses required by a character.

In order to provide dash markers, the keyers, which are capable of supplying the spaces between the dot markers, are made conducting. Thus if a keyer which is between two dot marking intervals is made conducting, the pulses in traveling down the chain of UIG's will activate three keyers in a row instead of one keyer, then miss the next keyer because it is being held gated off, then hit the next keyer which is not gated. This condition results in three keyers, two dot markers, and the space marker being on which together form an interval three times as long on the keying relay, giving a dash interval. These dash marking intervals can be inserted anywhere along the chain by gating the appropriate keyer. The keyers that are required to make the dash marking intervals are always the space marking keyers or the even-numbered keyers.

"Sequence Selectors"

Since the even-numbered keyer plate circuits are under the control of the "sequence selectors," it might be of interest to determine how these "se-

The New

Mandl's Television Servicing

● *gives you detailed, illustrated trouble-shooting procedures for every flaw or failure you're likely to encounter.*

A COMPLETE MASTER INDEX and separate lists of trouble symptoms for each circuit defect make it easy to locate any particular trouble and the exact procedures for correcting it. Unusual, hard-to-find flaws as well as all common trouble are dealt with.

THE LATEST CIRCUITS are explained and illustrated, including servicing techniques for UHF and VHF.

ORIGINAL PHOTOGRAPHS show actual symptoms that appear on the TV screen when defects occur. Hundreds of circuit diagrams, illustrations of station defects, scope patterns, and other illustrations aid in the identification and location of circuit faults.

and these are only a few of the features that make this the most helpful, practical, and complete service manual yet to be published.

Are these outstanding radio & TV aids on your working reference shelf?

Radio and TV Mathematics

by Fischer. Step-by-step solutions for hundreds of typical problems, arranged under radio and electronic headings for quick reference. Shows what formulas to use, what numerical values to substitute, how to solve each.

Television for Radiomen

by Noll. Very clear, non-mathematical explanation of all principles and full instruction on installation, alignment, adjustment, and trouble-shooting.

Television & FM Antenna Guide

by Noll & Mandl. A basic course on theory plus a complete handbook on all types of antennas and installation procedures.

Movies for TV

by Battison. Practical information on all equipment and experienced advice on the do's and don'ts of making newsreels, commercials, features, titles, special effects, cartoons, etc.

SEE THEM ON APPROVAL

The Macmillan Co., 60 5th Ave., N. Y. 11

Please send me copies of the books checked. I will either remit in full or return the books in 10 days.

☐ Mandl's TV Servicing $5. (prob.) Signed .....
☐ Radio & TV Math. $6.75 .....
☐ TV for Radiomen $7.75 Address .....
☐ TV & FM Antenna Guide $6.25 .....
☐ Movies for TV $5.00 .....

Finest
FRINGE AREA
Antenna



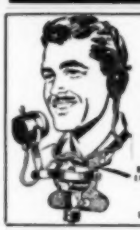
VELA

CORNER REFLECTOR
- HIGH GAIN 12 db
- BROAD BAND
- HIGH FRONT TO BACK RATIO
- RUGGED CONSTRUCTION

ORDER NOW!
Immediate delivery
LIST
$54.50

VIDEO ELECTRONICS
1220½ Grand Ave. Des Moines, Ia.

EASY MONEY!!
If you don't get our postcards telling the cash we'll pay for that surplus gear you bought when the buying was good, then YOU ARE LOSING MONEY! So send us your name and address NOW and GET ON OUR MAILING LIST!
G. L. ELECTRONICS
905 S. VERMONT AVE., LOS ANGELES 6



SOUND POWERED PHONES RCA-MI-2454
Complete with 24' of Rubber Covered Wire.
NEW EXPORT PACKED
Shipping weight 6 lbs.
$9.95 per set
2 for $19.50
EACH SET GUARANTEED
Brand New. Gov't. Cost $42.00
INCLUDES POSTAGE WITH ORDER
McCONNELL'S
3834 Germantown Ave.
Phila., Pa. RA 9-6033

RADIO-TV-ELECTRICAL TESTER
All-around Trouble Shooter



Will test Radio-TV tubes, ignition coils, condensers all types, spark plugs, transformers, speakers, etc., for opens, shorts, leaks, wire negatives. Sensitivity compares with VTVM. Tests 70-750 volts AC or DC. Tests mica, paper, oil, ceramic, air and electrolytic condensers for shorts, opens, leaks, and you can tell approximate capacity after few tests.
For all Engineers, Experts, and Beginners. *NO DANGER, NO SHOCKS, NO PLUG IN* and will not harm anything you test.
Only **$4.95** plus 25c postage
CHECKS INDUCTANCE, TOO.
3-day money back guarantee.
HOWARD SALES CO., Dept. RN-3
939 Atlantic Avenue Brooklyn 17, New York

T-V TUNERS
Continuous Tuning Printed Circuit Type
Broadcast inserts into any manufacturer. IDEAL FOR PARTS INCLUDING 13 VERNIER DRIVE AND MISCELLANEOUS CONDENSERS, RESISTORS, ETC. Sold as is. No refunds. Postpaid
$1.00 each, 3 for $2.50, $8.50 per dozen
Cash with order. Immediate delivery.
H & D PRODUCTS
P. O. Box 1276 Culver City, California

Advance with ELECTRONICS RICITY
You need firm grasp of fundamentals to keep pace with these complex, fast-growing fields. In thorough 2-year course learn electricity, electronics, physics, mathematics, drafting, etc. Other engineering and technical courses. Coed. Day, evening. 44th year. *Write for Catalog.*
FRANKLIN TECHNICAL INSTITUTE
46 Berkeley Street Boston 16, Mass.

quence selectors" operate to provide the proper number of dashes in the proper place. The "sequence selectors" consist of shielded grid thyratrons of the 2D21 type. Nine of them are used to form the dashes and the tenth one is in the circuit to release the thyratrons that have been activated. For example, consider "sequence selector" #18. This tube is held biased to cut-off and in the standby condition the tube will not draw current. When the tube is given a positive voltage pulse, approximately 12.5 volts, from the "phantom switch network," this triggering will cause the gas to ignite, the tube starts to conduct, the voltage across the plate resistor drops, and the cathode voltage rises to the plate potential, less the drop in the tube. This plate voltage is fairly close to the "B+" supply voltage due to the small value of the plate load resistor and the small current drawn by the circuit. Thus approximately 250 volts is available across the cathode resistor. This cathode voltage is applied to keyer #18 and serves as its plate voltage. Now keyer #18 is able to close the relay when a pulse is applied to its grid. This same process applies to all the other "sequence selectors." The "phantom switch network" will activate any number of these selectors which, in turn, will operate the keyers as required.

The gaseous tubes thus ignited will remain ignited unless some means of erasing them is brought into play. When the letter is completely transmitted, the trailing edge of the pulse from the cathode of the last UIG is used to signify that the character is completed. This trailing edge causes the erase tube, which is biased to cut-off, to trigger. Plate current starts to flow and the erase relay which is in series with the plate circuit opens, breaking a set of normally-closed contacts which are used to supply plate voltage to all of the "sequence selectors" as well as to itself. Therefore, when this erase relay is pulsed, it will automatically extinguish all of the other "sequence selectors" and the erase tube itself and the circuit is now ready to form another character.

—30—

PHOTO CREDITS

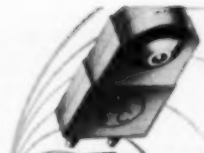
Page	Credit
35, 36, 37	Vernon C. MacNabb Co.
40, 62	Radio Corporation of America
46, 47	Codetyper Laboratories
52	Collins Audio Products Co., Inc.
56	General Electric Company
72	Electronic Workshop Sales Corp.
110	Empire State Building

ERRATA

In the diagram of Fig. 3 (page 48 of the November issue) pin numbers 4 and 5 on the 6V6 tube (V_3) should be interchanged.

* * *

In the article, "A Vacuum Tube Keyed Transmitter," appearing in the January issue, the diagram of Fig. 1B has two errors in it which should be corrected. The junction point of R, and R, should be connected to the top of the key jack instead of ground as shown and the leads to the open and closed contacts of the low current relay should be reversed.



for flawless reproduction

NO OTHER CARTRIDGE CAN PERFORM LIKE A PICKERING

Pickering *patented design provides* **DYNAMIC COUPLING*** *throughout the entire audible range*

* DYNAMIC COUPLING ASSURES
- constant stylus contact with the record grooves over the entire audio spectrum (20-20,000 cps)
- full frequency response
- full transient response

NO RESONANCES
NO MISTRACKING
NO GRINDING OF GROOVE WALLS

Well-informed engineers and technicians, schooled in the science of electro-mechanics, know that only wide-range frequency response provides full transient response; the electronic phenomena which enables the reproduction of orchestral music with all the subtle sounds that give each musical instrument its individual character.

Pickering engineers and designers have but one objective . . . to produce products that will please the music lovers' insatiable appetite for the flawless recreation of recorded music . . . for the utmost in quality insist upon Pickering Audio Components.

Pickering Cartridges transmit all of the sounds in the musical spectrum, without loss of definition, just as a fine optical lens passes all of the colors in the rainbow.

For literature address Dept. C

Pickering & COMPANY INCORPORATED
OCEANSIDE, NEW YORK

KEY ELECTRONICS

EVERYTHING you buy from KEY is fully guaranteed. If you are not satisfied you may return your purchase for credit or refund as you prefer. NO questions asked. All merchandise offered subject to prior sale. Minimum order $2.00. All prices are FOB Baltimore, Maryland. Shipment will be made by Railway Express Collect unless otherwise specified. Include 25% with all COD orders.

AUDIO OUTPUT TRANSFORMERS

900 V. Insulation 50-60 ma primaries. Secondaries match 2.2 ohms nominal.

Stock No.	Primary Impedance	Price Ea.
987	2,000 ohms	$0.49
772	2,400 ohms; with bucking winding	.49
247	2,500 ohms	.49
178	2,500 ohms; with bucking winding	.49
656	5,000 ohms	.49
574	6,000 ohms	.49
668	8,000 ohms	.49
430	1,100 ohms; with bucking winding	.69

HORIZONTAL OUTPUT (FLYBACK) TRANSFORMER. Equivalent to RCA 211T3 ..... 2.00 ea.

OIL-FILLED CAPACITORS

Capacity	Voltage	Price ea.
.2 mfd	1,000 V.D.C.	$1.49
3.5 mfd	220 V.A.C.	.69
4 mfd	3,000 V.D.C.	3.95
6 mfd	1,000 V.D.C.	3.29
7 mfd	220 V.A.C.	1.39
7 mfd	600 V.D.C.	2.69
8 mfd	1,000 V.D.C.	3.69
8 mfd	250 V.A.C.	2.75
10 mfd	1,000 V.D.C.	3.95
12 mfd	600 V.D.C.	2.50
16 mfd	330 V.A.C.	3.98

PAPER CAPACITORS, TYPE 770
.005 mfd, .01 mfd, .02 mfd
10 for $0.49
100 for 3.85
1,000 for 29.00

			Price Ea.
1.0 mfd	400 V.D.C.	C-D BM4100	.39
2.0 mfd	400 V.D.C.	C-D BM4200	.49
4.0 mfd	400 V.D.C.	C-D BM4400	.89

BLOWERS, A. G. REDMOND TYPE L
Approx. 100 cfm 115v., 60 cy. ..... $7.50 ea.

POWER TRANSFORMERS, 117 V., 50-60 C. Primaries

Stock No.	Description	Price
*1159	Sec #1-650 V.C.T. @ 150A; Sec #2-6.3V @ 2.1A; Sec #3-5V @ 3A Jefferson	$4.98
*1160	Sec #1—1450 V.C.T. @ 100A; Sec #2-6.3V @ 1.2A; Sec #3-5V @ 3A Jefferson	5.95
192	Sec #1, 700 V.C.T. @ 200A; Sec #2-6.3 V.C.T. @ 4A; Sec #3-5V @ 3A SNC	3.89
*8308	Sec #1-6.3V @ 10.6A; Sec #2-6.3V @ 1.5A; Sec #3-5V @ 3A C.T.; Sec #4-900V @ 141 S.C.T. Westinghouse, Tuffsrub Insulated	7.95

HIGH VOLTAGE TRANSFORMER. 117V 50-60 C Primary

*1158	Pri-117V., 50-60C. Sec. 4000V @ .025A. Jefferson	9.98
*1157	Sec #1 4V @ 16.5A; Sec #2 2.5V @ 1.75A	5.75
230	Sec #1 5V @ 3.25A; Sec #2 5V @ 3.25A rec. deliver 5V @ 6.5A; 10V C.T. @ 3.25A SNC	2.90

FILTER CHOKE

Stock No.		Price Ea.
647	5.6 Henries, .085A., 900V. ins.	$0.89
794	5.0 Henries, .030A., 900V. ins.	.95
#8350	10.0 Henries, .225A, 500V ins. Westinghouse, Tuffersrub Insulated	4.98
*1161	Dual 30 henry, .020A Jefferson	1.00

* Current ratings for these items are conservative. They are Government equipment and are underrated. High-voltage insulation.

TANK CIRCUIT. 150-200 Mc. Uses 2-826's in Metal Shield Box, complete w/tubes ..... $7.95 ea.

CONTROL STRIP, ANTENNA LINE. Uses 2-6000, 1-6082. Has 6VAC DPST relay. Complete w/tubes and relay ..... 2.90 ea.

KNOB ASSORTMENT ..... .20 for $1.00

SABRES TARZIAN TUNERS. Uses 1-6C4, 2-6AG5. Good condition. As is. less tubes 2.98 ea.

Panel light socket assembly assortment ..... .10 for $0.95

RECEIVER LOOP ANTENNA ASSORTMENT .10 for $2.39

AC LINE CORDS, MOULDED RUBBER PLUGS ASSORTED ..... 10 for 1.95

ATTENTION INDUSTRIAL USERS!!!!

We have large stocks of the following items:
Amphenol Connectors
Allen Bradley Potentiometers
T & B "Ste-Kon" Terminals
Tube Sockets
High-vacuum and Gas-filled Condensers
Compression Type Trimmer Capacitors
Mallory Switches
Magnet Wire
AMP Terminals
Barnby Holtzer
Pyrorlene Yarn
We invite your inquiries. We will reply the same day your query is received.
Write, wire, or phone—Phone No. Wilkens 6300.

Key Electronics Division
1801 N. LONGWOOD ST BALTIMORE 16, MARYLAND

SELENIUM RECTIFIERS

Full Wave Bridge Types

Current (cont.)	18/14 Volts	36/28 Volts	54/40 Volts	130/100 Volts
2 Amps.	$2.40	$3.75	$6.95	$10.50
4 Amps.	3.85	7.00	9.00	22.00
6 Amps.	5.65	9.00	.....	32.00
10 Amps.	6.95	10.95	.....	48.00
12 Amps.	7.50	14.00	.....	58.00
20 Amps.	13.25	20.50	.....	.....
24 Amps.	14.00	24.00	.....	.....
30 Amps.	19.00	30.00	.....	.....
36 Amps.	25.50	35.00	.....	.....

All our Rectifiers are new & Guaranteed one year. We manufacture special types of rectifiers and rectifier supplies to your specs. ..... FAST DELIVERY.

• Selenium Rectifier Specials

110 V., ½ Wave ..... 65 ma. ..... only 50c each
110 V., ½ Wave ..... 450 ma. ..... only $1.65 each

• New, Selenium Rectifier Transformers

PRI: 110V, 60 cycle in.	6 Amps.	$ 6.75
SEC: 18, 24, and 30 Volts	12 Amps.	16.75
	24 Amps.	35.75

Designed for Bridge or Center Tap use—Not Surplus.

• 110 V. PRI—36 V. @ 50 Amp. SEC $39.95
• 110 V. PRI—5 V. @ 130 Amp. SEC 85.00

QUALITY TESTED TUBES

Large stocks available, new and guaranteed in stock now; many others not listed—complete line of receiving tubes at low prices. In ordering tubes listed below, you may also order types not listed, at about same prices. Buy in full confidence on 100% guaranteed merchandise. Submit your requirements on any types for our quotation. Call us on Westinghouse and other types of industrial and special-purpose tubes. Large stocks of Germanium Crystals. Before you buy, let us quote you.

0A2	$1.00	6BE6	$ .70	12AT7	$1.00
0B2	1.10	6BG6G	1.20	12AU7	.75
0Z4	.55	6BH6	.60	12AV6	.55
1A7GT	1.00	6BK7	1.40	12AY7	2.75
1B3GT	.85	6BQ6GT	.70	12BA6	.70
1A24	1.10	6C4	.65	12BA7	.90
1N21	.80	6C8G	.70	12BE6	.70
1N21B	3.50	6CB6	.95	12BH7	1.00
1N23	1.45	6CD6G	1.75	12SM7	.95
1N23A	2.50	6F7	.90	12SN7	.75
1N23B	3.75	6F8G	.90	12SK7	.75
1N34	.65	6H6	.75	12SL7	.75
1N34-A	.85	6J5GT	.85	12SQ7	.75
1R5	.65	6J6	.75	25BQ6GT	.90
1U4	.65	6J7	.95	25L6GT	.85
2B7	.75	6K6GT	.79	35C5	.60
3A4	.95	6K7	.75	35Z5GT	.55
3A5	1.10	6K8	.80	50C5	.60
3D6	.50	6L7	.90	50L6GT	.60
3Q4	.55	6R8	.90	80	.60
3Q5GT/G	1.00	6SA7	.75	304TL	9.95
3S4	.90	6SF5	.85	304TH	9.95
5FP7	1.95	6SG7	.90	717-A	.90
5U4G	.59	6SH7	.70	807	1.65
5V4G	1.05	6SK7	.75	955	.45
5X4G	.85	6SL7GT	.75	956	.37
5Z3	.95	6SN7GT	.85	1616	.75
6AB4	.75	6SQ7	.75	1624	1.40
6AC7	.90	6T8	1.25	1625	.40
6AJ5	1.65	6U6GT	.80	1626	.40
6AK5	.95	6V6GT	.60	1629	.30
6AL5	1.30	6V6M	1.50	5608-A	2.95
6AL5	.59	6W6GT	.60	5686	3.95
6AQ5	.85	6X4	.45	5930	.75
6AM6	1.50	6X8GT	.45	9004	.44
6AN5	2.95	7A6	.65	9005	1.50
6AU6	.65	7B7	.80	9006	.44
6AV6	.55	7N7	.80	9006	.44
6B4G	1.25	12A6	.75	VR-105	1.25
6BA6	.70	12C8	.85	VR-150	.90

• TV "Cheater" Cord—6 Ft. Complete, U.L. Approved. Reg. list 59c. Special 39c

• ART-1—75 meter Deluxe Mobile AM XMTR. Complete. Only $45" with Built in Pwr. Supply. New in $75.00

• All 11 Complete Radio Station in a Suitcase! Superhet RCVR. and 35 watt CW XMTR. 110 and/or 220 VAC Supply Built in. 4 Tube 16 Mtr. Ten Brand-new Deluxe Sets in Stock. Write for Details.

• CARTER, 6 Volt Dynamotors Brand New—400 Volt @ 225 ma. List Price $71.40. Your Cost—Special $26.00

"NOTE: COLLEGES, UNIVERSITIES, INSTITUTIONS, LABS, M'FRS., INDIVIDUALS . . . OR ANYONE HAVING NEW TUBES AND OR EQUIPMENT IN LARGE OR SMALL QUANTITIES—SUBMIT DETAILED LIST FOR OUR CASH OFFER."

BARRY ELECTRONICS CORP

136 Liberty Street, N. Y. 6, N. Y. REctor 2-2563

Terms: 25% with order, balance C.O.D.—Send a few cents for postage—All merchandise guaranteed. F.O.B. N.Y.C.

Classified

Rate 50c per word. Minimum 10 words

RADIO ENGINEERING

COMPLETE radio, electronics theory & practice: television; broadcasting; servicing; aviation, marine, police radio. 12 or 18 months. Catalog. Valparaiso Technical Institute, Dept. N, Valparaiso, Ind.

SALE

10 WATT all triode high fidelity audio amplifiers. Built-in preamplifier, separate tone controls, seven tubes ... $67.50. Send for particulars. Electronic Wiring, Selden, L. I., N. Y.

DIAGRAMS Radio, Record Changers, Recorders, 75c; Television with Service Data, $1.25 up. State manufacturer and model number. Kramer's Radio Service, Dept. N8, 36 Columbus Ave., New York 23, N. Y.

"SUBSTITUBE" beats tube shortage, 900 direct Interchangeable tubes listed. Chart 50c. Alexander, 780 E. 214th St., N. Y. C.

SAVE $7.50! Pickering D-1408 Diamond LP Cartridges, $28.50 each. More "High Fidelity" equipment bargains. Free list. Skalamera, 435 E. 74th St., New York 21.

HALLICRAFTER SX-62 with R-44 speaker. Excellent condition, $180.00. D. Quentin Glenn, 500 Franklin St., Carlisle, Pa.

TV and FM Antennas. Yagi, Conical, Bow-Tie. Mounts, accessories. Lowest prices. Wholesale Supply Co., Dept. H, Lunenburg, Mass.

HEARING aids, used. Zeniths, less accessories, $7. One-piece Nationals, $10. One-piece overhauled, with accessories, $20.00. Shelby Instrument, 321 W. 7th St., Long Beach, Calif.

TUBES, surplus, bought-sold. Free list. Betz, 73 Caroline Ave., Yonkers, N. Y.

TELETYPE machines and parts, new or used. Will buy, sell, trade. Manhattan Electronics, 2191½ S. Sepulveda, Manhattan Beach, Calif.

WANTED

AN/APR-4, other "APR-," "ARR-," "TS-," "TE-," ARC-1, ARC-3, ART-13, everything surplus: Tubes, Manuals, Laboratory equipment. Describe, price in first letter. Littell, Farhills Box 26, Dayton 9, Ohio.

FRENCH Importer looking for surplus SCR 510 or parts. Write Morellec, 2 rue Mademoiselle, Paris.

HELP WANTED

RADIO Officers, $7,200-$10,000 annual earnings, top union conditions, 6 months Radio Operating experience U.S. Merchant ships on FCC License since Jan. 1, 1935, can get emergency FCC License to sail at once. Also experienced U.S.N. Radiomen with 2nd class Radiotelegraph license & 6 months sea Radio time. Phone, write, wire American Radio Association, CIO, 5 Beekman St., New York. CO 7-6397.

CORRESPONDENCE COURSE

USED Correspondence Courses and Books sold and rented. Money back guarantee. Catalog free. (Courses bought.) Lee Mountain, Pisgah, Ala.

RADIO Servicing Course shows latest short cut methods. Lessons easy to follow. Only $3.00, postpaid in U.S.A. Buyers Syndicate, 30 Taylor St., Springfield, Mass.

MISCELLANEOUS

SPEAKERS repaired, wholesale prices, guaranteed workmanship. Amprite Speaker Service, 70 Vesey St., New York City 7.

WALKIE TALKIES $4.99 Complete Set of 2

POCKET SIZE



—ELECTRONIC VOICE POWERED

No tubes, batteries, adjustments, license or permit needed! Guaranteed to work anywhere up to ¼ mile with extra wire. Swell for office to house, etc.! Your own private, talk-listen phone. Not war surplus. Brand new. Solid state circuits. Case. Two complete units with wire—READY TO USE! SEND ONLY $4.99 (deposit) and pay postman $4.99 C.O.D. or send $4.99 for PP delivery. Limited supply. MIDWAY COMPANY, Dept. WRT-5, KEARNEY, NEBRASKA.

Another Outstanding Jobber!

OLYMPIC ELECTRONICS SUPPLY

1440 W. OLYMPIC BLVD.
LOS ANGELES 15, CALIF.



EICO has all 17 KITS & INSTRUMENTS in stock!

See EICO Ad on Page 111

PEN-OSCIL-LITE

Extremely convenient test oscillator for all radio servicing; alignment • Small as a pen • Self powered • Range from 700 cycles audio to over 600 megacycles u.h.f. • Output from zero to 125 v. • Low in cost • Used by Signal Corps • Write for information.

GENERAL TEST EQUIPMENT
38 Argyle Buffalo 22, N. Y.

From the earliest days of Radio . . . . to the present era of Television . . . .

CORNISH WIRES

"Made by Engineers for Engineers"

CORNISH WIRE CO., Inc. — 50 Church St., N. Y. C. 7

Superintendent of Airline Communications
OVERSEAS AIRLINE

Free housing. Pays over $600 per month. Must be thoroughly capable of planning and installing ground and aircraft radio equipment. Also must be well qualified radio technician capable of supervising radio repair shop. Write, SAA, Trans World Airlines, Employment Manager, Kansas City 6, Missouri.

ON-THE SPOT **BATTERY RECORDER**

WALKIE-RECORDALL ® lb. miniature BATTERY RECORDER-PLAYBACK

Continuous, permanent, accurate, indexed recording at only 5c per hr. Instantaneous, permanent playback. Picks up sound up to 60 ft. Records conferences, lectures, dictation, 2-way phone & sales talks; while walking, riding or flying. Records in closed briefcase with "hidden mike"! Write for Detailed Literature.

MILES REPRODUCER CO., INC
812 BROADWAY Dept RN-4 NEW YORK 3, N. Y.

REPAIR PARTS FOR BC-348 (H, K, L, R only)

Also BC 224 Models F, K. Coils for ant., r.f., det., osc., I.F., p.a. osc., std. filters, 4 gang cond., front panels, dial assemblies, vol. conts., etc. Write for complete list and free diagram.

HIGH QUALITY CRYSTAL UNITS

Western Electric—type CR-1A AR in holders, ½" pin spacing. Ideal for net frequency operation. Available in quantities. 5010-6130-6570-6470-6510-6010-6670-6080-6040-7270-7350-7380-7300-7480-7580-6720. All fundamentals 6 Kc. to 8 Kc. Also multiples to higher frequencies ..... $1.25 each

ELECTRONICRAFT, INC., 27 Milburn St., Bronxville 8, N. Y.

LEARN TELEVISION

ELECTRONICS and RADIO
Engineering Laboratory and Classroom Training. Day and Evening Classes.

Write for illustrated Catalog

ELECTRONICS INSTITUTE, Inc.
21 HENRY, DETROIT 1, MICH.

QUALITY · SERVICE · DEPENDABILITY

DUMONT PERFECTLY CENTERED COMPLETELY MOLDED **CAPACITORS**

Sold and Preferred Everywhere

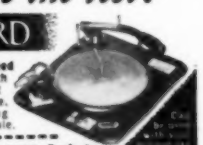
DUMONT Electric Corp.
308 Dyckman Street, New York 34, N. Y.

Enjoy the best!

GARRARD

Outplays the rest!

GARRARD



World's Finest 3-speed Record Changer with Automatic stop. Quiet motor. Heavy turntable. Prevents disturbing resonance, wows, rumble.

GARRARD SALES CORP., Dept. 3N
164 DUANE ST., N. Y. 13

Gentlemen:
I am interested in learning what to look for when purchasing a 3-speed record changer. Please send me, without obligation, your FACT SHEET.

NAME_____
ADDRESS_____
CITY_____ ZONE____ STATE_____

MARCH 1952

INDEX OF Advertisers

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

NAME	PAGE
Acorn Electronics Corp.	106
Amos Radio Corp.	32
Allied Radio Corporation	27, 140, 152
Alma Radio Company	142
Aluminum Products Corp.	107
Altec Lansing Corp.	106
American Phenolic Corporation	26
American Television & Radio Co.	100
Ampertite Company, Inc.	158
Ampex Electric Corporation	123
Amplifier Corporation of America	130
Argos Products Company, Inc.	162
Arkay Radio Kits, Inc.	162
Arrow Sales, Inc.	149
Asbo Radio Co., Walter	25
Atlas Tel Rad Company	158
Audel Publishers	148
Barry Electronics	106
Bell Telephone Laboratories, Inc.	12
Belmont Radio Corporation	7
Bendix Radio	143
Blonder Tongue Labs	135
Bond Equipment Company	114
Brook Electronics, Inc.	102
Brooks Radio and Television, Inc.	144
Burstein-Applebee Company	122
C & H Sales	140
Candler System Co.	140
Capitol Radio Engineering Institute	93
Channel Master Corp.	9
Chicago Transformer Company	111
Cinch, H. G.	120
Circle Sales Co.	148
Cleveland Institute of Radio Electronics	95
Collins Audio Products	14
Columbia Electronic Sales	132
Comet Electronic Sales Co.	143
Communications Equipment Company	105
Cornish Wire Co.	106
Coyne Electrical School	112, 161
Davis Electronics	114
DeForest's Training, Inc.	5
Dow Radio, Inc.	98
DuKane	120
Dull's Electrical Translations	158
Dumont Electric Corp.	100
Eastern Telephone Co.	132
Editors & Engineers, Ltd.	112
Edlie Electronics, Inc.	114
Electronic Expeditors, Inc.	113
Electronic Instrument Co., Inc. 3rd Cover, 34, 132, 140,	166
Electronic Specialty Supply	146
Electronicraft, Inc.	166
Electronics Institute, Inc.	166
Electro Products Laboratories	148
Electro Sales	162
Electro Voice, Inc.	115
Engineering Associates	162
Exeter Sales	145
Exeter Manufacturing Company, Inc.	135
Fair Radio Sales	113
Feiler Engineering Co.	154
Fisher Radio	155
Forest Sales	120
Franklin Technical Institute	164
G. L. Electronics	138, 164
Garrard Sales	166
General Apparatus Co.	164
General Electric Company	13, 31
General Test Equipment	166
Gonset Company	141
Goodheart, R. E.	162
Graybarne Corporation	127
Greenlee Tool Co.	157
Greenwich Sales Company	138
Greylock Electronics Supply Co.	151
H & D Products	164
Hallicrafters Company, The	22
Harvey Radio Company, Inc.	108
Heath Company	76 thru 83
Henry Radio Stores	159
Hickok Electrical Instrument Co.	24
Hollywood Technical Ins.	166
Howard Sales	164
Hytron Radio & Electronics Co.	33
Indiana Technical College	162
Instructograph Co.	90
J. F. D. Manufacturing Company	104, 154
J. S. M. Sales Company	158
Jensen Industries, Inc.	30
Jensen Mfg. Co.	102
Jontz Mfg. Co.	116
Joseph Radio Parts Inc., Irving	129
Kaar Engineering Company	146
Ken-Way Products, Inc.	127
Key Electronics Division	165
Lafayette Radio Corporation	149
Lampkin Laboratories	148
LaPointe Plascomold Corporation	10
Leotone Radio Co.	161
Littelfuse Incorporated	21
Lowell Metal Products Corp.	136
Luther, Otto	142
Macmillan Company	164
McConnell's	153, 164
McGee Radio Company	98, 99
McGraw-Hill Book Company	146
McIntosh Laboratory, Inc.	167
Mallory & Co., P. R.	4th Cover, 17
Mark Electronics	147
Midway Company	106

(Continued on page 166)

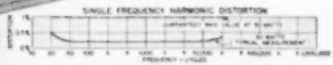
Comparison proves—

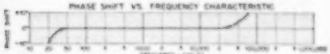
McIntosh

WORLD'S FINEST AMPLIFIER!

50W-2 Amplifier
50 Watts (Peak 100)







• Less than 1% harmonic or intermodulation distortion even at peak power—reproducing the entire audible range from 20-20,000 cps.

Compare McIntosh 50W-2 with any amplifier—at any price. For it is only by such comparison that you can fully appreciate the truly superior qualities of this unique, patented instrument that has reached the theoretical limit of quality and efficiency! No other amplifier can give you so much power with so little distortion, at such low cost.

Write today for technical information and name of nearest dealer.



AE-2A Amplifier Equalizer

Mc INTOSH LABORATORY, INC.
322 Water St., Binghamton, N. Y.

STAY ON THE AIR
WHEN POWER FAILS...with an ONAN Electric Plant



AUTOMATIC START & STOP

Model 10EL, 10KW A.C.

When storms, floods, or fires interrupt electricity and force you off the air, you lose listeners and income. Guard against loss, assure vital public service during emergencies by installing an Onan Electric Plant. Onan Standby Electric plants serve many network and private stations. Automatic models to 35,000 watts.



PORTABLE ELECTRIC PLANTS FOR MOBILE RADIO USES

Supply A.C. power for broadcasting at scene of events. Light in weight. Can be carried by hand or in trunk of car. A.C. models: 400 to 5,000 watts.

Write for FREE Folder

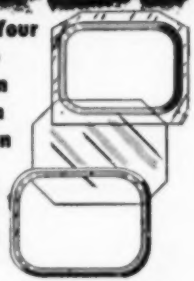
Onan

D. W. ONAN & SONS INC.
4817 University Avenue
Minneapolis 14, Minnesota

CRONAME TV CONVERSION KIT

Be Proud of Your Big Tube Conversion or Custom Installation

3 Professional Quality Components



1. Metal Mask Tailored for Perfect Fit.
2. Heavy ¼" Tempered Safety Glass.
3. Beautiful Gold Finished Metal Escutcheon.

All Popular Sizes: 14", 16", 17" and 20"

Easy Installation Instructions Included

Order CRONAME TV CONVERSION KITS; CRONAME TUNING DIALS, KNOBS and ACCESSORIES from Your Parts Jobber.

Send for New CRONAME Catalog.

WALDOM ELECTRONICS, INC.
911 N. Larrabee St., Chicago 10, Ill.
Mfrs. of Replacement Speaker Cone Assemblies

TRIPLEX WAVE MASTER

TRIPLE DIRECTORS

¼ Wavelength Stacked

TWO BAY STACKED CONICAL

Conical with 3-Element Dipole

GHOST FREE RECEPTION ALL CHANNELS

NO BOOSTER REQUIRED

YOUR COST $8.90

44 INCH ELEMENTS

INSTANT ASSEMBLY

MATCHES ANY OHM WIRE 75-150-300

IMMEDIATE DELIVERY

20% Deposit C.O.D. Orders

EASY INSTALLATION APPROX. WT. 7 POUNDS

Price List $26.90

UNDER ACTUAL TESTS...PROVED!

- Most advanced design to date.
- Easier tuning, added selectivity on any receiver.
- 30% more gain than former 4X antennas.
- These tests conducted in fringe areas and locations up to 250 miles from transmitting stations—not by motor or laboratory tests, but under average home installation.
- Reception available in fringe and formerly unsatisfactory locations, all channels.

SOLD DIRECT—WRITE—WIRE—CALL—FAIRFAX 9171

RAY CO. 441 SUMMIT ST. TOLEDO, OHIO

SPECIAL OFFERING

TO T.V. SERVICE COMPANIES & DEALERS

STANDARD BRAND TUBES

All are first quality. Many in original factory boxes. All individually boxed.

0A4	$0.72	6BC5	$0.95	12AU6	$0.90
1B3	.95	6BE6	.80	12AU7	.90
1R5	.85	6BG6	1.50	12AV6	.75
1S5	.85	6BJ6	.85	12AV7	1.35
1T4	.80	6BN6	1.40	12BA6	.75
1U4	.80	6BQ6	1.20	12BE6	.75
1U5	.80	6CB6	.80	12BH7	.95
1X2	1.05	6CD6	.90	12K8	1.00
3Q4	.95	6CQ6	2.40	12SA7	.85
3S4	1.10	6CS6	.80	12SK7	.80
3V4	.90	6J5	.65	12SR7	.80
5U4	.75	6J6	1.15	12SQ7	1.10
5V4	1.10	6K6	.80	12SQ7	.75
5Y3	.50	6K7	.80	19BG6	2.40
6AC7	1.10	6SN7	.95	25A7	1.80
6AG5	.85	6SQ7	.85	25B8	.90
6AG7	1.25	6SN7	.95	25Z5	.90
6AH6	.95	6T4	.80	35B5	.90
6AK5	1.35	6T8	1.25	35L6	.65
6AL5	.85	6V6GT	.80	35Z5	.65
6AQ5	.85	6W4	.95	47	1.10
6AR5	.75	6W6	.90	50A5	1.00
6AT6	.70	6X5	.90	50B5	.90
6AV5	.65	6Y6G	.95	50C5	.90
6AV6	.70	12AT6	.65	50L6	.90

10% from total price reduction on all orders of 50 tubes or more. Minimum order $10.00.

TELEVISION ANTENNAS

CONICAL 6 ELEMENT 4 elements, 4 reflectors high gain, all channels for general use. Packed 4/5 to a carton. Less than 5 ea. $2.90 ea. $3.15 ea.

DOUBLE BAY CONICAL with stacking rods, 5 elements, 4 reflectors per bay. Two sticks with 14 wave connecting bars. Solves fringe problems. Packed 2/3 to a carton. Less than 3 ea. $6.40 ea. $6.99 ea.

FOLDED MI-LO $3.99 ea.

ANTENNAE ACCESSORIES

EAVE MOUNT (12")	Heavyweight	$1.50 pr.
EAVE MOUNT (15")	Heavyweight	2.00 pr.
EAVE MOUNT (18")	Heavyweight	2.25 pr.
EAVE MOUNT (24")	Heavyweight	3.00 pr.

SPECIAL 300 OHM TV WIRE $15.00 per M ft.

1st quality 55 mil web, 22 gauge pure polyethylene and 7 strand pure copper. 1000 ft. spools in lots of 5 M ft. Less than 5M ft. $17.50 per M

TERMS: 20% deposit with order. Balance C.O.D. F.O.B. N.Y.C. Include shipping charges with postal order.

ATLAS TEL-RAD PARTS

153 CHAMBERS ST., DEPT. RN-3, NEW YORK 7, N.Y.

Phone: NAncyer 2-5813

STAN-BURN S-P-A-R-K-S

ANTENNAE SPECIALS

	1-11	12 Or More
DOUBLE V ¾" Dowel	$2.98	$2.20
DOUBLE V ½" Dowel	3.45	2.45
DOUBLE V ¼" Dowel	3.95	2.95
10 Element Conical ¾" Dowel	3.55	2.55
Folded Hi Straight Low Quick Mi-Lo Antennae	4.25	3.25
WINDOW CONICALS	4.95	3.75
MASTS		
5 FOOT SWEDGED	.89	.69
10 FOOT PLAIN	1.59	1.29
TV WIRE		
42 Mil. 300 ohm	$15.95 M Ft.	
55 Mil. 300 ohm	17.95 M Ft.	
72 OHM COAXIAL	52.50 M Ft.	

CATHODE RAY TUBE SPECIALS

7JP4	$15.00	16RP4 KP4 N.U.	23.00
10BP4	14.95	16RP4A	26.00
10BP4 N.U.	19.95	17BP4A	27.00
10BP4A N.U.	19.95	20CP4	39.50
12LP4	19.95	20CP4 Sheldon	52.00
12LP4A	19.95	19AP4A	47.95
14BP4	19.95	19DP4A	47.95
16DP4A	26.00	24AP4A	73.00
16GP4	33.00	Single ion traps	3.9
16AP4A	39.00	Double ion traps	5.9

CHASSIS 630 K10 VIDEO $139.50

OPEN FACE CABINET 19.00

TRANSFORMERS

Nationally Advertised

RCA type for 16" to 24" X0132 $1.85

G.E. type for 16" to 24" X0145 $1.85

These are very special prices while they last!

DEFLECTION YOKES

COSINE FERRITE

TODD YOKE 70° $4.20

REGULAR 70° YOKE 3.85

CONDENSER SPECIALS

BY PASS—ALL GUARANTEED

20+20-150	Stan Burn	$0.45	
30+30-150	Stan Burn	.49	
20+150	Stan Burn	.32	
8-450	Stan Burn	.41	
16-450	Stan Burn	.59	

4 Prong Vibrators each $1.25

Lots of 12 or more 1.19

Standard TV Tuners $18.95

Hi-S Guaranteed Tuners (with tubes) $12.00

SPECIAL! While they last

SPEAKER SPECIALS

ALL GUARANTEED

4" P.M.	$1.64
5" P.M.	1.79
6" P.M.	2.41
8" P.M.	3.41
12" P.M.	6.33
4x6 P.M.	2.19
5x7	3.73
5x7	3.43
10" P.M.	5.48

AUTHORIZED DISTRIBUTORS for General Electric, Kendall, Tung-Sol, National Union, Jewel, De Ward, Regal, Automatic and Sylvania Carbons.

We carry a complete line of popular makes of Radio and TV tubes, at 50% discount. Also many other special purpose and transmitting types, and all electronic parts and equipment at lowest prices. Send us a list of your requests for quantities and prices.

Terms: 20% with order. Balance C.O.D. All prices F.O.B. NEW YORK Warehouse. Minimum order $5.00.

Write for our latest price list to Dept. RN-3

STAN-BURN RADIO and ELECTRONICS CO

(C.B.S. THEATRE BLDG.)

1697 BROADWAY • NEW YORK 19, N.Y.

INDEX OF ADVERTISERS

(Continued from page 167)

NAME	PAGE
Midwest Radio & Television Corp.	88
Miles Reproducer Company, Inc.	166
Milwaukee School of Engineering	134
Mosley Electronics	159
Moss Electronics	97
National Electronics	162
National Radio Institute	3
National Schools	11
Newark Surplus Materials	84
Newcomb Audio Products	133
New England Television Corp.	160
Niagara Radio Supply Corporation	101
Offenbach & Reimus Company	122
Ohmite Mfg. Company	6
Olson Radio Warehouse	86, 87
Olsen & Sons, D. W.	167
Peak Electronics Company	156
Penn Boiler & Burner Mfg. Corp.	103
Planetshi Chemical Company	128
Photocon Sales	102
Pickering and Company, Inc.	105
Platt Electronics	110
Poly-Tech Company	130
Precise Development Corp.	142
Precision Electronics, Inc.	154
Premax Products	144
Premier Radio Tube Co.	117
Prentice-Hall, Inc.	157
Progressive Electronics Company	129
RCA Institutes, Inc.	85, 132
Radcom Engineering Co.	163
Radio and Television News	139
Radio Corporation of America	Second cover, 75
Radio Craftsmen, Inc., The	160
Radio Ham Shack, Inc.	121
Radio Music Corp.	145
Radio Receptor Co., Inc.	135
Rad-Tel Tube Co.	153
Ray Mfg. Co.	168
Raytheon Manufacturing Company	15
Refonic Sales Co.	151
Regency	88
Rek-O-Kut Co., Inc.	122
Rider, Publishers, Inc., John F.	119, 147, 148
Rinehart Books	28, 29
Rogers-Phillips Research Labs.	124
Sams & Company, Howard W.	8, 128
Sarnett, Robert	88
Sarkes-Tarzian	152
Schott Company, Walter L.	13
Service Management	106
Simpson Electric Co.	126
Snyder Manufacturing Company	30
South River Metal Products	160
Sprague Products Co.	99
Sprayberry Academy of Radio	19
Stan Burn Radio & Electronics	168
Standard Surplus	109
Standard Transformer	141
Star Electronics Distr., Inc.	152
Steve-El Electronics	137
Sun Radio of Washington, D. C.	96
Superior Instruments Co.	161
Sylvania Electric Products	10
Tab	169, 170
Tallen Company	162
Techni-Master Products Co.	158
Telo-Ex-Pand Products Sales Corp.	146
Television Communications Institute	163
Television Supply Company	89
Teletex, Inc.	90
Transvision, Inc.	131
Trans World Airlines, Inc.	88, 166
Triad Transformer Mfg. Co.	118
Trio Manufacturing Co.	120
Triplett Electrical Instrument Co.	20
TriState College	144
Ungar Electric Tool Company, Inc.	129
University Loudspeakers, Inc.	159
V & H Radio & Electronics	153
Vaetron	163
Valparaiso Technical Institute	106
Video Electronics	164
Waldom Electronics, Inc.	167
Weathers Industries	136
Weller Electric Company	18
Wells Sales, Inc.	89
Wholesale Radio Parts, Inc.	150
Workshop Associates, Inc.	98
World Radio Laboratories, Inc.	147
YMCA Trade & Technical School	147



AUDIO (Sound) ENGINEERING COURSE

Home Study Training

BIG PAY JOBS open in Television, Radio, Electronics, Disc Recording and Motion Pictures. Recognized and Approved Training. Write for complete details. TODAY!

HOLLYWOOD TECHNICAL INSTITUTE
3359 Cahuenga Blvd., Dept. B. K.
Hollywood 28, California

PRECISION RESISTORS

Over 2½ Million in Stock

"TAB"—Specialists in Precision Resistors

No Mfrs Choice—We Ship Types in Stock

0.1%	286	1.3%	3500	1%	116000
0.42	289	1350	3509	17577	116667
0.425	295	1355	3600	18000	120000
0.607	300	1400	3750	18300	122000
0.7	310	1408	3730	18380	125000
0.703	311.5	1425	3900	18750	130000
1.7	320	1500	3900	16800	141000
1.78	325	1500	4000	19000	142000
2.5	330	1515	4020	19500	1470.30
3	340	1600	4200	20000	150 .30
3.63	350	1620	4220	20541	160 .30
4	360	1646	4280	20500	160 .30
4.15	366.6	1650	4300	21000	165 .30
5	370	1670	4314	21500	166750
5.025	375	1680	4320	21500	167500
6.25	380	1710	4444	22500	169200
7	390	1712	4500	23000	175000
7.5	396	1740	4720	23500	180000
7.8	400	1770	4750	23150	180600
7.9	402	1780	4840	23285	180600
8	414.3	1818	4885	23400	186600
10.36	416.8	1818	4885	23400	186600
11.25	425	1850	5000	24000	198000
13.32	426.9	1850	5000	24000	198000
14	427	1892	5210	25000	201000
14.5	430	1894	5215	25200	205000
15	440	1900	5300	25500	210000
16	450	1896	5300	25833	215000
17	460	1898	5360	26000	220000
19.2	460	1898	5600	26500	225000
19.5	464	1900	5600	26600	225000
20	475	1900	5770	27000	231000
23	498	1901	5910	27500	235500
23	499	1902	5940	27500	236000
24	487	1903	6100	28430	240000
25	500	1904	6100	28500	240000
26	510	1905	6140	29000	250000
28	515	1906	6150	29000	250000
30	525	1907	6300	29990	268000
31.5	530	1908	6300	30000	270000
37	550	1909	6500	31000	275000
40	560	1910	6800	31500	294000
45	562	1911	6800	32000	300000
51.78	580	1912	6990	33000	307500
56	590	1913	7000	33000	310000
56.7	600	1914	7320	36000	314000
60	610	1915	7500	36000	325000
63	620	1916	7700	38140	325000
68	625	1917	7700	38500	330000
74	633	1918	7900	39000	350000
75	640	1919	7930	39500	350000
80	650	1920	8000	40000	350000
81.4	645	1924	8000	41400	375000
88	645	1924	8000	41500	375000
95	650	1960	8200	41000	390000
100	650	1960	8200	41000	390000
101	665	2000	8500	42000	400000
103.2	670	2000	8500	47000	402000
105	670	2045	8700	47500	420000
105	675	2050	8700	47500	420000
107	675	2095	9000	48560	425000
108	680	2100	9000	48560	425000
110	681	2142	9445	50000	450000
120	681	2142	9445	50000	450000
121.2	689	2150	9710	50000	460000
125	689	2150	9710	50000	460000
130	699	2160	9900	56000	478000
133	700	2187	9902	57065	500000
147.5	715	2200	10000	58333	510000
150	733	2200	10430	60000	520000
160	750	2200	10430	61000	520000
168	750	2100	10600	62000	525000
170	800	2400	10600	62000	550000
175	806	2450	10936	65000	550000
178	820	2483	11000	66500	560000
180	825	2487	11000	66500	570000
182.4	854	2490	11500	67500	575000
182.5	860	2500	11500	68000	600000
200	900	2525	12000	70000	620000
209.4	900	2525	12000	72000	625000
210	917	2625	12800	73500	654000
210	950	2700	13000	80000	660000
220	978	2700	13500	80000	680000
220.4	1000	2750	13950	82000	690000
225	1000	2800	14000	82000	700000
230	1058	2860	14000	85000	750000
233	1058	2868	14000	85000	761 .30
240	1067	2900	14400	88000	800000
245	1100	3000	14450	90000	800000
245.4	1110	3100	14550	91000	820000
250	1150	3161	14600	93000	850000
260	1155	3300	14600	93000	850000
270	1162	3290	15000	95000	900000
275	1200	3300	15900	95000	900000
278	1225	3333	16800	100000	930000
280	1250	3384	17000	110000	950000

Any Size Above, Each 35c; Ten for $3.29

MEGOHMS

.1	1.57	2.7	4	6.7	10
.11	1.65	2.75	4.23	7	11.55
1.2	1.78	2.8	4.25	7.5	12
1.5	2	2.87	5	8.25	12.83
1.3	1.9	3	5.1	7.74	13
1.35	2	3.3	5.5	9	15 .89
1.39	2.11	3.5	5.5	9.02	30
1.4	2.2	3.73	6	9.5	91
1.5	2.25	3.75	6.2	9.8	
1.57	2.5	3.9	6.6	9.5	

Any Size Above, Each 70c; Ten for $6.49

Vacuum Precision HiVolt Resistors

Megohms—12 / 23 / 6.75 / 83.99 / 1.5 /

2 / 3.75 5% Accy. Ea. $1; 10 $7.50

TUBE SOCKETS, ALL TYPES

A. 8CA 5-pin GIANT, Steatite $1.40
B. Johnson 5-pin Socket Bases, Asst. etc. .85
C. 304TL Socket Bases, Asst. etc. .85
D. Johnson Type Steatite, 828 .60
E. Johnson 22-227, 8KA227, 813 .69
F. Small Steel DIHEARAL 2HP1 .75
G. JC Med Shell DIHEARAL Ceram .90
H. 5-pin ALDEN 1.9-16" dia HAMLOK .39
I. Johnson 122-227 Tube Lock .90
J. 4-prong STEATITE Johnson 866 .20
K. 5-prong STEATITE Johnson, 807 .20
L. 5-pin STEATITE, 1625 .20
M. 5-pin NATIONAL CHT1 Steatite .30
N. 5-pin Med Mica, 8-10 .30
O. MINI 5-pin, Mica, B Top Mtg & Shield B .30
P. MINI 7-pin, Bot Mtg Mkt Sim Amph 147-500 .33
Q. NOVAL Shield ..... 12c; 1.15/10"
R. AMPH 6-pin 75P Pin 4,5,6,8 .17
S. 4-AMPHENOL 86SG1 Steatite .17
T. OCTAL 8-pin & plate Bklite .10
U. OCTAL 8-pin & plate Steatite .20
V. OCTAL 8-pin & plate Mica, B .11
W. OCTAL 8-pin & lock Mica, B HF .10
X. OCTAL Socket Saver .50
Y. LOKTAL Amph 4055L Steatite .30
Z. LOKTAL Amph 7856 mica Bklite .20
AA. U-TAL 7851/4931 Amph .16
BB. U-TAL Amph 4054 Steatite .30
CC. HiVoltage 4-pin Amph 77AL .39
DD. MAGNAL 8-pin Ceramic 5MP1 .69
EE. MYKROY HV SAFETY SKT 866A .98

VARIABLE CONDENSERS

150mmf 300Vdc HF	$1.39
Dual 75mf ea, Sect 1000V	1.29
JOHNSON 70HM3 to mmf 3000V Gap	1.25
Cardwell Mout 27-12mmf 500V	.98
CARDWELL TK-300-CS 53 to 312 mmf can be made split Stator	10.95
Vernier Drive 10 to 360mmf, each	.98
Midget 3 to 15 mmf Midline, each	.39
21/2 Meter Butterfly Condr (mmf w/ Br Tank & Choke	99c; 2 for 98c
PLANETARY DRIVE 1 Dia. SHAFT 5 to 1 Ceramic 27067	1.49

"TAB"

THAT'S A BUY

HIGH CURRENT MICA CNDSRS.

CYLINDRICAL SIMILAR TYPE G

Mfd	Amps	Mc	Each
.0005	15	30	$14.98
.001	15	30	5.98
.002	15	30	5.98
.0025	15	30	4.98
.005	15	30	39.95
.0025	25	30	39.95
.005	25	30	49.00
.0025	35	30	49.00
.005	35	30	49.00
.0025	50	30	49.00
.005	50	30	49.00
.0015	3.3	3	1.98
.001	20	30	110.00

OIL CAPACITORS

Mfd	Each	Mfd	Each
.9Kvdc		1	1.59
4	$0.49	1	2.98
.15Kvdc		2	2.98
1	.59	15	4.98
.25Kvdc		.1400vdc	
.25	.35		.59
.3Kvdc		1	1.29
1	.39	1500vdc	
.4Kvdc		1	1.59
	.49	.75	1.59
.5	.59	1	1.69
1	.69	2	2.29
2	.98	3	2.98
4	2.29	4	3.98
.6Kvdc		2000vdc	
1	.69	.25	1.49
2	.89	.5	1.59
4	1.49	1	1.75
.7Kvdc		2	2.98
1	.98	4	3.98
.8Kvdc		2500vdc	
.25	.49	.25	2.29
.5	.79	1	3.98
1	.98	3000vdc	
2	1.49	1	2.49
4	1.98	2	3.98
1Kvdc		4000vdc	
1	.69	1	4.49
2	1.00	2	6.98
3	1.49	5000vdc	
4	2.29	1	6.49
1.2Kvdc		7000vdc	
1	.89	.002	1.69
2	1.49	.005	1.98
4	2.98	.01	2.98
1.5Kvdc		1	4.98
1	.98	7500vdc	
2	1.49	.001	2.98
4	3.98	.002	3.49
800vdc		10000	4.98
1	.69	12000	6.98
1000vdc		12000 vcdc	
.45	.79	.002	4.98

RHEOSTATS



2 ohm 50W Ohmite	$2.89
6 ohm 25W Ohmite	1.98
15 ohm 25W Ward L	1.98
15 ohm 150W Ward L	3.74
20 ohm 50W Ohmite	2.25
25 ohm 25W Ward L	2.38
100 ohm 50W Ohmite	2.25
250 ohm 50W Model D	2.25
250 ohm 50W Ward L	2.40
500 ohm 200W Model P	5.49
1000 ohm 200W Model P	5.49
1000 ohm 25W Ward L	2.50
1000 ohm 50W Ohmite, Slotted shaft ..... 25 watt 79c; 3 for	2.00
1000 ohm 50W Ward L	2.50
1500 ohm 50W Ward J	2.59
1500 ohm 50W Model J	2.89

ATTENUATORS TOP MFGS

7470 & 1063 ohm 12 step W.W. $3.98
DUAL 2500 ohm 20 step 3.98
DUAL 10000 ohm 20 step 3.98
100,000 ohm 20 step Model Step 3.98

ALLEN BRADLEY POTENTIOMETERS

1 ohm Type J 1¼ Flatted Shaft $1.25
200 ohm Type J 1¼ Slotted Shaft 1.25
3500 ohm Type J 1¼ Flatted Shaft 1.45
3500 ohm Type J 1¼ Slotted Shaft 1.45
5K ohm Type J 1¼ Slotted Shaft 1.25
25K ohm Type J 1¼ Slotted Shaft 1.25
50K ohm Type J 1¼ Flatted Shaft 1.45
50K ohm Type J 1¼ Slotted Shaft 1.25
1 meg Type J 1¼ Flatted Shaft 1.25
1 meg Type J 1¼ Triple 1½ Shaft 4.69

CONNECTORS AND CABLE

UG-1 ..... $.20	UG-57 ..... $0.60
UG-10 ..... 2.20	UG-83 ..... .14
UG-21 ..... 1.80	UG-254 AU 3.40
UG-21A 1.80	UG-236 ..... .60
UG-21B 1.50	M359A ..... .75
UG-22 ..... 1.50	UG-274 ..... 2.45
83-1SP 83-1SQ Receptacle, 50c; 10 for	3.90
83-1SPM Plug ..... 85c; 10 for	6.90
83-1SP-PL259 Plug ..... 50c; 10 for	4.75
83-1SP-PL258 Junction	.95
CHOKE A JK-20 A, RL-5 Ft.	1.98
Same as above 8 Ft. $1.29, 12 Ft.	1.49
RG-8/U Coaxial Cable ..... Per Ft.	.12
RG-11/U 5 Ft. Lengths ..... Per Ft.	.12
UG-277 6-CNDTR, P to RC 312	1.00

UHF ANTENNA

UHF ANTENNA 12" 30CM ATS (ARR) Universal Mount Incls. 5 sect Tele Rod & 6' Coax Wpf Gash & H'ware Mtng ..... 12c; 1.15/10"

PL259 for above ..... 39c; 4 for $1.00

TV CONICAL ANTENNA (Dubi-X) Sturdy Portable Versatile TZ, 150 ohm Match, Incl. 8 elements & 100 ft. All Copper Cross Bar & H'ware Brand New, Only $8.49

Dubi-Shaped Conical Array similar but with 16 elements & all hardware plus 300 ft. All Copper Twinlead Brand New $12.98

MICROWAVE ANT AS125 APR. 100c; to 1mc Hi Gain Tenna Indksit Hdtrap Fits Flange Mtg Incl H'ware $6.98

ANT AN1323A ..... Whip $1.98

ANT AN1321A ..... 11 ft, 8 sect 3.98

WG40-52, 12½ ft. $1.49

BASES; MP22 $3.98; MP48 ..... 3.98

TRANSFORMERS



115 V 60 Cyc Input TV & CR Filter 5v 2a, 6.3v 4a, 2.5v 2a Totten, Hi VOLTS to 2000 V Transformer ..... ALL Tubes, FIL & FIL wires Hi Voltage $7.98

Power Trans for 6.4V 2A, 6.3V 4.5A, 2.5V 2A Hi Volts to 2000 V Transformer $7.98

1320V & 375VCT 110MA $3.98

1.25A $9.98

1100VCT 200MA $5.98

660VCT 200MA $4.98

10.5VA $6.98 ..... 2 for $12.98

1000VCT 125MA, 5VCT 150MA, 2A 5V, 3A 6.3V, 2A 6.3V CT, 2A 2.5V CT $9.98

1000VCT 45MA, 5VCT 50MA, 6.3VCT 2A, 6.3VCT 2A, 5VCT 3A $9.98

900V 35MA $3.98

1100 Each side CT, 5VCT 3A, 6.3V 2A $2.49

900V 28A $2.49

640VCT 110MA $2.98

3A 6.3V 3A 6.3V CT, 2A 6.3V, 2A 5V, 2A 5V CT, 2A 6.3V, 2A 6.3V CT, 2A 6.3V CT, 2A 6.3V CT, 2A 6.3V CT $4.98

770VCT 85MA, 2V 2A, 6.3V 3A, 6.3V 3A $3.98

770VCT 85MA, 2V 2A, 6.3V 3A, 6.3V 3A, 6.3V 3



SELENIUM POWER SUPPLY

0-12 VDC/2amps. Variable DC supply, cased & completely built—115 VAC input. Usable for lab, filament DC, Plating, batt charging model railroad. Includes voltage or speed control w/center off reversing switch. Ideal for two "HO" locomotives. **Special $10.95, 2 for $20.00**

SOLDERING IRON GUN



Sensational value, light weight, heavy dty soldering gun, w/ removable alloy tip will not corrode. Tip is flat, can be used for soldering large and small parts. "TAB" Special Money Back Gtd. **$8.99**

PARTS CABINETS



50 Draw Hvy Steel 34½"H/18"W/9"L/65Lbs. drawer 3"W/2½"H/8"L @$38.00
100Draw as above @$63.00
27Draw Hvy Steel 37"H/30¾" W/14½"L/120 Lbs. Draws 3"H/9"W/12"L $39.95
Write for Quantity Price "Extend Inc"

LINE FILTERS

10Amp/130vacdc Cd0.1to1000 Mc's $1.20
30Amp/250vacdc Cd0.1to1000 Mc's 3.98
60Amp/600vdc/250vac. Fltrs both sides of line. SOLAR "Elim-O-Stat" New $6.98
100Amp/usable 110 vacdc GE 2 for $1.98

CIRCUIT BREAKERS

Heinemann Magn Brkrs. Amps: 0.22, 2, 3, 5, 7, 9, 12, 15, 20, 30, 35, 40, 60, 100. **Each $1.60; 10 for $15.00**
Sq D & CH Toggle Sw brkrs. Amps: 5, 10, 15, 20, 25 ...... **Each 98c; 10 for $8.98**
Klixon Thermal Push Button Brkrs. Amps: 5, 10, 15, 20, 25, 30. **Ea. 89c; 10 for $7.98**

SWITCHES AND MICROSWITCHES

SPNC/10A/WZ-RQ11/Plunger $0.69
SPNO/10A/YZ-7RTC Pin Plunger ...... .54
SPNO/10A/G-TRS1/Plunger ...... .59
SPNC/30A/B-1/HI-ALT/Cased 1.25
NONC/BZ-2R1TC/1¼" LEAF ...... .98
NONC/MLB3T3/3¼" LEAF 1.08
6 AMP 125V Removed from Equip. Brkt. Gtd. **CLEAN** SPST 4/$1 DPST 3/$1

"TAB" THAT'S A BUY

NEW THRIFT-LITE Lifetime Photo-Flash



Not a kit. Incl Pwr prk, Life gtd Lamp, Rflctr & 15' cord 1/1000 Sec flash every 7 sec. True daylite color. Usable all cameras oper 115VAC w/lite Type AC40 ...... **$41.98**

Complete Outfit for AC & Battery opr. Incl AC40&BP25 portopak & all accesrs for KODAK&COMPUR Shutters Complete **$69.95**. Write for Complete "THRIFTLITE" Data Boosterpacks, Ext lites, Units for Focal plane shutters & accessories. WE BUY, SELL & SWAP

TAB "SUN-FLASH" LAMPS



"Tab" No.	Replaces	W-Sec. Max.	Each
U10	GE FT114	100	$ 9.98
No. 1	AMGLO 5804X	100	10.98
23ST	GE FT210	200	10.98
53GT	GE FT403	500	16.98
VA	SYLV. 4330	200	11.98
23MT	FT214	250	10.98
22ST	FT110	200	10.98
5530TQ	FT503	5000	54.98

84340 FLASH TUBE—Nationally Advtsd @ $57. NEW $36.00
K-400 Air Corps Lamp 14.98
Booster Packs External Light and Complete Line of Accessories.

MERCURY THERMO REGULATOR

DUAL CKT. 105°F & 92° F. Extremely sensitive & accurate for most exacting requirements—Research, Fire Prev., Freeze, Pt Control, or Max-Min Temp Control. Brand New. Individ. Boxed w/data & ckt. SPECIAL **Ea. 98c; 12 for $10.00**
Ball Pens Gtd Red or Blue ...... 5 for $1.00
Ball Pens Draftsman Black ...... 2 for 1.00

"WILLIAMSON" 10W HI-FI KIT



10 to 30000cycles with Ease! Internationally Famous: For HiFi enthusiasts. Incl Pwr supply, Selected parts: Balanced resists **$29.95**
W'mson ProAmp Kit & Tone boost Amplifier, chassis, parts, pwr supply **$34.95**
SUPER-Wide-Range Hi-Fi TRIODE 10W KIT, 10to20000 cycles, 6B4G's, Max Harmonic Distortion 1¾% at full outpt & only ½% at 5W output. Includes Bass & Treble tube boost & Tone ckts 4PreAmp G.E. pickup 3dual & 2output (7) tubes, Parts, RCA chassis & info., less output sformer **$29.95**
UTC Hi-Fi Outpt Xfrm for P.P. 2A3, 6B4, 6A5 & 6L6. Cnd cap 30W; Sec 5 taps 2½ to 250 ohms **$6.98**
GE Reluc Cartridge perm needle $1.98
GE Dual Reluc Cartridge RPX 050 ...... $7.29
GE Reluc Cartridge RPX040 or 041 ...... $7.29
GE S1201D Hi-Fi 12" PM Spkr $15.98
Phono Motor 33RPM w/ADJ Speed $4.69
Sensational 10" HiFiSpkr Ideal 10 Watt Home Size. Concentric, Separate Driver **Woofer & Horn Driver Tweeter—30 to 16000 cps Range English Mfgr** $18.98
Electro Voice EV16M dual twist Cart $3.98
"LP" Anti-Static fluid GUD 1000 plays 69c
Extra dual needle for Twist Cart $1.30



Hi Gain Dynamic Mike & Xfrm. Buy Comb. Spcl. Dyn Mike & Xfmr $1.98
XFMR Hmtsld UTC SuperElect 3 wdg. 600—ct & 4000tapped 250 & 150—can be used Mike to Grid, Line to Grid & Line to Line. Cnd & Hmt Sld **SPECIAL 49c; Ten for** **$4.49**

CRYSTALS



Mtd FT243 exacting Sec. Specs 3535Kc, 3700Kc, 3825Kc, 3655Kc, 3735Kc. **Ea. $1.25; 4 for $4.75**
Write for other Frequencies.
Htr. Oven Xtals—HiAccy 5010 5025, 5055Kc. ...... **ea. $14.98**
Rochelle Salt Xtals. 89c; 10 for $5.00

SOCKETS FOR CRYSTAL HOLDERS

4-crystal holder ⅛" pins, ¾ & ½" spacing ...... **Each 10c; 12/$1**
HiFreq Dual Xtal holder ...... **10c; 12/$1**
HF Holder ½" spacing ⅛" pins **10c; 12/$1**
Johnson Mycalex 3 pin BENDIX **35c**

METER SPECIALS



Best Buy—6 Ma DC Tuning Meter, G.E. 2½" dia. **$1.29**
SPECIAL—0-15 VAC. 2 1/16" Rd., GE, 800 cyc. USN. **$1.69**

MISC. TYPES

0-800 Volts DC, Weston 3" square built in Mult $12.98
0-8 Volt AC, Weston 3½" 3.49
0-15 Volt AC, Weston 476 3" Sq. 4.98
0-150 Volt AC, Weston Rect. Type 8.98
0-50 Microammeter Weston 3" Sq. 16.98
0-300 Microammeter DeJur 2½" 6.98

DC MILLIAMMETERS

0-1 Ma 3" sq. Weston 7.50
0-10 Ma & 0-5KV (Basic 1 Ma), 3½" 4.98
0-10 Ma & 0-1RW (Basic 1 Ma), 3½" 4.98
0-25 Ma. Weston 3" sq. 6.98
0-300 Ma. Weston 3" sq. 5.98

DC AMMETERS

0-1A, 3½" Wstghs 4.98
0-5A, 2½" Triplett 3.49
0-10A, 3" sq. Triplett 3.98
0-15A, 2½" Triplett 3.49
0-30A, 2½" Shunt WECo, Wstghs 2.98
0-60A, 2½" Int. Shunt, WECO 3.49
0-120A, 2½" Ext. Shunt WE/Wstg 3.98
0-240A, 2½" Less Shunt 3.98
0-300A, 3" Less Shunt, WECo 4.49
30-0-30A, 2¾" Weston 201P&Wstg 4.98
60-0-60A, 2½" W Shunt, WE Wstg 4.98
120-0-120A, 2½" Shunt, WE/Wstg. 3.98
240-0-240A, 2½" Less Shunt, GE 3.69
480-0-480A, 2½" Less Shunt, Wstg. 3.69

RF METERS

0-1A, 2½" G.E. USN—H'Csd 3.98
0-3A, Simpson 2½" Bklt Csd 4.25
0-8A, 3" Triplett Hi-Freq.; Int.Couple 4.98
0-5A, 2½ Wstghs USN 2.49
0-5A, 2½" Rnd Wstghs 3.79
0-120MA, Weston 3½" to 65 Mc 12.95

VOLUME LEVEL INDICATOR
−20 + 3VU, Weston, 3 sq 10.98

Infrared Snooperscope



Image-Converter Tube Hisensitivity simplified design 2" dia. Willemite, Screen-Resolution up to 350 lines/in. Complete data & tube TAB Special. **Each $4.98; 2 for $9.49**

TUBES

"TAB" TESTED & GUARANTEED

PRICES SUBJECT TO CHANGE

0A2	$1.25
0A3 VR75	1.42
0A4G	1.49
0B2	1.45
0B3 VR90	1.21
0C3 VR105	1.43
0D3 VR150	.98
0Y4	2.91
0Z4	.79
V8-1	12.49
C1A	9.75
01A	.69
1A3	1.10
1A4P	.79
1A5GT	.79
1A6	1.49
1A7GT	1.33
1AE4	1.80
1B3/8016	.98
1B4P	.89
1B5/25S	.89
1B7GT	.89
1B21/471A	2.49
1B22	3.21
1B23	9.90
1B24	17.49
1B26	2.65
1B27	24.00
1B32/532A	3.90
1B35	1.98
1B37	18.00
1B38	29.95
1B40	4.95
1B41	49.95
1B42	18.00
1B46	1.98
1B51	49.95
1B56	38.50
1B59	350.00
1B60	69.75
1L1C	2.70
1C5GT	.89
1C6	.79
1C7G	.89
1D5GP	.89
1D7G	.89
1D8GT	.89
1E5	.89
1E7G	.89
1F4	.89
1F5G	.79
1F6	.89
1F7G	.89
1G4GT	.89
1G6G	.89
1G6GT	.79
1H4G	.89
1H5GT	.89
1H6GT	.79
1J5G	1.20
1J6GT	.79
1L4	.89
1L6	.98
1LA4	1.19
1LA6	.89
1LB4	1.29
1LC5	.79
1LC6	1.36
1LD5	.89
1LE3	.89
1LH4	.89
1LN5	.79
1N5GT	.89
1P5GT	.75
1P42	4.75
1Q5GT	.89
1Q26	69.00
1R4 1294	1.25
1R5	.79
1S4	1.19
1S5	.79
1S21	6.90
1T4	.79
1T5GT	.89
1U4 5910	.89
1U5	.79
1V	.79
1V2	.70
1X2	.98
1Y2	6.98
1Z2	1.98
2A3	1.79
2A4G	1.19
2A5	.89
2A6	.89
2A7	.89
2AC15	4.98
2AS15	4.98
2B7	.89
2B22	3.90
2C21 1642	.67
2C22/7193	.33
2C26	.19
2C26A	.47
2C33 RX233A	3.49
2C34 RK34	.69
2C39	33.98
2C40	9.98
2C40 JAN	19.90
2C43	26.75
2C43 464A	9.49
2C44	1.20
2C51	7.98
2C52	3.98
2D21	1.49
2E5	1.19
2E22	1.25
2E24	4.85
2E25 HY65	5.15
2E26	3.49
2E30	2.19
2J21	10.95
2J21A	9.35

2J22	7.90
2J31	29.75
2J31A	79.95
2J32	69.95
2J33	39.35
2J34	38.90
2J36	120.00
2J37	12.70
2J38	17.75
2J39	49.90
2J42	250.00
2J48	29.90
2J49	39.45
2J50	27.90
2J52	249.50
2J56	199.50
2J62	49.45
2K25	31.95
2K25/723AB	29.45
2K29	21.95
2V3G	1.25
2W3GT	.98
2X2	.69
2X2A	1.49
3A4	.99
3A5	1.49
3A8GT	1.39
3B4	2.98
3B5	.98
3B7/1291	.69
3B23/RK22	4.95
3B24	5.40
3B25	4.90
3B26	3.70
3B28	6.90
3C6 XXB	1.49
3C22	125.00
3C23	10.98
3C31/C1B	3.45
3C33	14.98
3C34/HK24	5.49
3C45	15.90
3D22	13.95
3D21A	3.39
3D23	4.90
3E29	14.95
3LF4	1.29
3Q4	.89
3Q5GT	1.29
3S4	.79
3V4	.79
4-125A	29.95
4-250A	40.98
4-1000A	108.50
4B27	4.98
4C25/HK54	5.98
4C32	59.00
4C35	28.98
4C36	15.98
4C27/257	14.98
4J22	148.50
4J31	95.00
4J34	194.00
4J42/700	27.00
4J47	260.00
4J47CV	198.00
4J52	350.00
4T4/2	5.98
4X150A	41.00
4X-500F	85.00
5AX4GT	.54
5AZ4	1.15
5C22	53.35
5C30/C5B	3.98
5D21	24.30
5D23	24.95
5LS8 HD	16.98
5J29	12.40
5R4GY	2.20
5R4WGY	2.98
5T4	2.45
5U4G	.77
5V4G	1.39
5W4	.89
5X4G	.79
5Y3GT	.49
5Y4G	.79
5Z3	.99
5Z4	1.29
C6A	6.75
6A3	1.55
6A4	1.95
6A5G	2.15
6A6	.99
6A7	1.32
6A8GT	1.09
6AB4	.75
6AB5 6N5	1.33
6AB7 1853	1.39
6AC5GT	1.09
6AC6G	3.49
6AC7	.99
6AD6G	.98
6AD7G	1.49
6AF6G	1.33
6AG5	.89
6AG7	1.98
6AH5G	1.49
6AH6	1.99
6AJ5	2.15
6AK5	1.39
6AK5W	2.98
6AK6	1.49
6AL5	.69
6AL7GT	1.29
6AN5	5.95
6AQ5	.88
6AQ5W	4.98
6AQ6	1.00
6AQ7GT	1.19
6AR5	.79
6AR6	2.98
6AS5	.79

6AS6	2.75
6AS7G	4.50
6AT6	.82
6AU5GT	1.49
6AU6	.89
6AV5GT	1.29
6AV6	.59
6AW6	1.89
6AX5GT	.79
6B4G	1.78
6B5	1.19
6B6G	.89
6B7	1.19
6B8G	1.09
6BA6	.79
6BA7	1.19
6BC5	.89
6BD5GT	1.23
6BD6	.89
6BE6	.79
6BF5	1.08
6BF6	1.49
6BF7	2.65
6BG6G	1.65
6BG7	1.98
6BH6	.89
6BJ6	.98
6BK7	2.15
6BL7GT	1.49
6BN6	1.49
6BN7	1.29
6BQ6GT	1.29
6BQ7	2.15
6BY5G	3.45
6C4	.69
6C5GT	.79
6C6	.79
6C7	1.20
6C8G	.89
6C21	20.45
6CB6	.89
6CD6G	2.49
6D4	3.49
6D6	.89
6D7G	.89
6D8G	.89
6E5	.89
6E7	1.39
6F4	6.19
6F5	.79
6F6	.79
6F6GT	.79
6F7	1.39
6F8G	1.39
6G6G	1.39
6H6GT	.69
6H6	.69
6J4	9.89
6J5GT	.59
6J6	1.20
6J7	1.00
6J8G	1.10
6K4A	4.75
6K5GT	1.09
6K6GT	.70
6K7	.89
6K8	.99
6L5G	.79
6L6	2.41
6L6G	1.69
6L6GA	1.69
6L6GAY	2.29
6L7	1.19
6N4	2.39
6N5G	1.69
6N7GT	1.29
6P5GT	.89
6Q7	.89
6R6	.99
6R7	1.39
6S4	.89
6S7G	.89
6S8GT	.89
6SA7GT	.89
6SA7GTY	2.37
6SB7Y	1.19
6SC7	1.39
6SD7GT	.89
6SF5	.89
6SG7	.89
6SH7	1.39
6SJ7	.90
6SK7GT	.89
6SL7GT	.89
6SN7GT	.79
6SN7WGT	2.25
6SQ7GT	.79
6SR7	.69
6SS7	1.09
6ST7	1.11
6SU7GTY	1.37
6SZ7	1.05
6T7G	.89
6T8	1.09
6U4/6AX4	.79
6U5/6G5	.89
6U6GT	1.09
6V3	1.80
6V6	2.25
6V6GT	.69
6V8	1.99
6W4GT	.89
6W6GT	.89
6W7G	1.33
6X4	.69
6X5GT	.79
6Y6G	1.27
6Y7G	.89
6Z7G	.89
6ZY5G	.89

7A4/XXL	.89
7A5	.99
7A6	.79
7A7	.99
7A8	.89
7AD7	1.49
7AF7	.89
7AG7	1.99
7AH7	1.19
7B4	.79
7B5	.79
7B6	.79
7B7	.89
7B8	.89
7C4/1203A	.79
7C5	.98
7C6	.89
7C7	1.49
7C23	72.00
7C29	69.95
7E5/1201	1.29

14A7/12B7	.99
14AF7/XXD	1.19
14B6	.99
14B8	.89
14C5	1.09
14C7	1.09
14E6	.99
14E7	1.09
14F7	1.09
14F8	1.29
14H7	.99
14J7	1.19
14N7	1.49
14Q7	1.09
14R7	1.19
14S7	1.09
14W7	1.09
14X7	1.21
15E	1.98
15R	.89
FG17/5557	4.75
18	.98

49	.83
50	1.19
EF50	.98
50A5	1.19
50B5	.79
50C5	.69
50C6	1.49
50L6GT	.69
50X6	.89
50Y6GT	.79
50Z7G	.98
52	.99
53	.69
T55	8.75
55	1.06
56	.85
57	.75
58	.70
RK59	1.45
59	1.78
T60	10.49
HY69	4.98

262B	3.98
274B/5R4	1.90
276A	9.89
T300	26.98
304TH	9.75
304TL	9.50
307A RK75	4.85
310A	6.75
311A	7.90
311CH	10.95
311CT	10.50
311T	10.50
313C	2.98
316A	1.49
323A	24.25
327A	4.95
350A	6.50
350B	5.90
353A	4.65
HK354	24.98
355A	14.15
368AS	7.75

815	2.90
816 866Jr.	1.09
826	.95
828	11.29
829	11.49
829B	13.45
830B	3.49
832	5.65
832A	9.75
833A	39.45
834	5.95
836	4.75
837	1.55
838	3.98
843	.39
845	4.90
849	29.45
852	19.98
860	4.90
861	23.95
864	.39

Top Dollar Paid for Your Surplus Tubes—Send List and Prices

7E6	.89
7E7	.69
7F7	1.25
7F8	2.19
7G7/1232	1.29
7H7	.89
7J7	1.09
7K7	1.29
7L7	1.19
7N7	1.19
7Q7	.79
7R7	.99
7S7	1.09
7T7	1.03
7V7	1.39
7W7	1.19
7X7/XXFM	1.19
7Y4	.69
7Z4	.69
9DC-15	4.98
10Y	.45
UXCV11	8.25
CV11	8.25
12A	.89
12A5	1.39
12A6	.89
12A7	1.29
12A8GT	.79
12AC7	1.45
12AH7GT	1.99
12AK5	1.98
12AR5W	2.98
12AL5	1.11

19	.89
19BG6G	1.79
19T8	1.09
19V8	1.63
T20/1623	3.79
TUF20	8.19
TZ20	3.79
20	1.17
RK20A	8.95
RK21	3.78
22	.89
24	.85
24A	1.10
24G/3C24	1.90
25A6	1.09
25A7	2.98
25AC5GT	1.59
25AV5GT	1.29
25BQ6GT	1.19
25C6	1.18
25L6GT	.69
25W4GT	.89
25Y5	.79
25Z5	.79
25Z6GT	.99
26	.79
27	.69
HY27	10.95
FG27A	8.70
RK28A	4.89
30	.79
31	.59
HY312	2.75

70A7	1.59
70L7GT	1.59
71A	.79
V70D	4.48
CRP72	1.37
CRP73	1.49
73	1.67
NR74	.29
HY75	4.69
75	.99
75TL	6.89
76	.79
77	.69
78	1.06
79	.89
80	.69
81	1.69
FG81A	3.90
82	1.19
82V	1.39
83	1.45
83V	1.79
84/6Z4	.99
85	.79
89	.75
VR92	.25
FG95/5560	24.85
FG98	19.95
100TH	8.89
102D	3.98
102G	3.98
FG104	37.98

371B	.90
380A	.79
388A	1.49
393A	6.90
394A	4.90
FP400	15.98
X400	14.98
417A	8.95
GL434A	29.95
446/2C40	1.19
446B	3.89
450TH	44.00
460	19.95
WL468	13.95
GL471A	2.69
GL502A	1.79
WL652	65.00
GL530	22.00
531	6.98
WL532	3.89
550P1	19.95
575A/975	13.75
WL579	10.49
WL579B	12.98
601B	.19
HY615	.25
616	37.00
HU627	19.00
WL670A	11.98
WL676	39.95
WL677	34.00
WL686	35.00
701A	5.89

865	1.29
866A	1.69
868 CEIC	3.49
869	39.95
872A	3.69
GE-872A	5.49
874	1.39
876	1.95
884/6Q5G	1.80
885	1.45
893A	250.00
922	1.75
923	1.00
927/CE25	1.45
929	1.33
930	1.25
931A	6.90
954	.29
955	.40
956	.39
957	.45
958A	.47
967/FG17	4.75
973	10.75
991	.39
FM1000	1.50
CK1005	.85
CK1006	3.49
CK1007	.89
CK1090	2.69
R1100	5.00
R1130	12.00
E1148	1.35

Use Your Priority for SPEEDY DELIVERY—Extend Your DO & Contract Nos.

12AT6	.59
12AT7	1.49
12AU6	.89
12AU7	.95
12AV6	.69
12AW6	1.79
12AX4GT	1.20
12AX7	.99
12AY7	2.95
12BA6	.79
12BA7	.79
12BD6	1.75
12BE6	.89
12BF6	.85
12BH7	1.29
12BY7	1.38
12BZ7	1.25
12C8	1.35
12F5GT	.79
12H6	.89
12J5GT	.89
12J7GT	.89
12K7GT	.89
12K8	.99
12Q7GT	.79
12S8GT	.98
12SA7GT	.85
12SC7	1.39
12SF5GT	.79
12SF7GT	.89
12SG7	.89
12SH7	1.10
12SJ7GT	.79
12SK7	.89
12SL7GT	.79
12SN7GT	.89
12SQ7GT	.79
12SR7	.98
12X3	.90
12Z3	.89
14A4	1.09

32	.49
FG32/5558	13.85
32L7GT	1.49
33	.59
34	.69
35/51	.89
35A5	.79
35B5	.70
35C5	.69
35L6GT	.79
35T	4.89
35TG	3.45
35W4	.59
35Y4	.69
35Z3	.79
35Z4GT	.69
35Z5GT	.59
REL36/6J4	.49
36	.65
37	.69
38	.59
RK39	2.89
39/44	.59
CRC40	.59
T40	4.29
TZ40	3.98
40	1.09
HY40Z	3.75
41	.79
42	.69
43	.65
45	.65
45S/VT52	.65
45Z3	.69
45Z5GT	.89
46	.89
47	.99
48	1.99
RK48A	14.85
RK49	7.90

FG105	18.98
VU111	1.45
HY114B	.75
HY115	.79
117L/M7GT	1.59
117N7GT	1.79
117P7GT	1.39
117Z3	.59
117Z4GT	1.39
117Z6GT	1.19
117Z7GT	1.49
F123A	6.49
T125	13.49
F127A	19.98
VT127A	3.90
CV148	4.98
150T	14.90
VT158	14.49
FG166	49.00
FG172	42.90
182B	1.20
FG190	12.80
T200	22.98
201A	.98
203A	5.98
205B/VT2	1.69
CE206	3.15
211/VT4C	.45
CE215	8.98
RK215	9.95
WE215A	.18
217C	8.75
227A	4.98
231	1.20
242C	6.49
244A	4.15
247A	9.95
250R	9.90
250TH	22.25
250TL	16.50
HK254	14.49

702A	3.29
702B	5.98
703A	6.98
704A	.98
705A/8021	2.79
707A	10.49
707B	17.49
710A/8011	.95
713A	1.00
NL714	6.95
714AY	5.90
715A	6.45
715B	9.65
715C	24.25
717A	1.49
718BY	48.45
718CY	48.45
719A	49.95
721A	2.49
722A/287	2.45
723A	6.75
723A/B	14.40
724A	3.95
724B	3.95
725A	7.45
726A	6.90
726B	59.95
726C	69.95
801A	.45
802	3.98
803	3.89
804	8.95
805	3.90
807	1.67
808	2.98
809	3.43
810	10.98
811	2.90
812	2.90
813	8.65
814	3.88

HY1231Z	5.39
1612	1.98
1613/676X	.98
1616	.90
1619	.25
1620	5.75
1622	2.69
1624	1.90
1625	.42
1626	.42
1629	.35
1630	.97
1631	1.25
1632	.77
1633	.73
1634	.73
1635	1.49
1636	3.19
2000T	149.50
2050	1.79
2051	1.19
R4340	36.00
5516	5.98
5517	3.39
5594	8.65
5608A	5.95
5637	7.15
5638	4.79
5651	3.05
5654	4.79
5656	19.98
5663	1.85
5670	6.98
5684	14.98
5686	4.23
5687	5.75
5692	7.89
5693	7.69
5694	3.65
5718	10.15
5719	12.75

5726	4.39
5749	4.39
5751	5.45
5763	1.70
5812	2.99
5814	5.49
5881	3.29
5840	12.75
X6030	4.49
UX6653	.69
8002R	99.50
8005	5.85
8008	6.49
8012	2.89
8013	2.75
8013A	6.45
8014A	28.95
8020	1.25
8025	5.79
9001	1.65
9002	1.29
9003	1.69
9004	.99
9006	.29

Sub-Miniatures

1AD4	2.95
2E31	1.49
2E36	1.49
2E41	2.39
2E43	1.39
2G21	2.39
CK501X	1.26
CK501AX	1.26
CK502AX	1.79
CK503AX	1.79
CK505AX	1.79
CK506AX	1.79
CK509AX	1.26
CK512AX	1.79
CK522AX	1.79
CK525AX	1.79
CK526AX	2.98
CK528AX	2.39
CK529AX	2.98
CK531DX	.98
CK532DX	.98
CK533AX	1.39
CK534AX	.89
CK536AX	.89
CK537AX	4.98
CK538DX	.89
CK539DX	.98
CK541DX	1.98
CK542DX	.98
CK543DX	.98
CK544DX	.98
CK546DX	1.98
CK547DX	1.98
CK571AX/5886	6.98
CK573AX	2.98
SD828	.98
SD969	.98
CK1027	3.35
CK1028	6.98
CK1089	4.65
CK1090	4.65
CK5672	3.15
CK5676	2.98
CK5678	2.45
CK5697	5.98
CK5702	7.25
CK5703	1.08
CK5704	5.79
CK5783	6.69
CK5784	7.40
SA29	5.98

C'Ray Tubes

CK5851	4.98
CK5875	1.98
2AP1	11.90
3AB1	12.95
3AP1	14.25
3BP1	7.95
3BP1A	14.98
3CP1	2.20
3DP1	4.85
3EP1	4.98
3FP7	1.69
3FP7A	14.98
3GP1	4.70
3HP7	3.85
3HP14	14.98
3JP7	12.50
3JP12	19.95
3JP14	16.95
4AP10	4.69
5AP1	5.98
5BP1	4.49
5BP1A	14.98
5BP4	4.75
5CP1	4.75
5CP7	11.95
5CP7A	9.98
5FP7	1.89
FP14	18.95
5HP1	9.75
5HP4	6.75
5JP2	24.40
5LP1	29.95
5MP1	9.75
5NP1	5.85
7BP1	4.95
7BP7	6.75
7EP4	17.98
7JP4	18.39
9GP7	14.89
9LP7	5.95
10BP4	18.29
12DP7	16.89
12DP7A	49.50
12GP1	49.98
12GP7	16.89
12HP7	16.89
12JP4	27.00
12KP4	47.00
902	10.65
905	3.49
912	89.98
913	11.98
914A	45.00

Vacuum Capacitors

MMF	KV	Each
25	7.5	3.49
50	7.5	1.49
100	7.5	6.98
12	20	9.98
50	20	9.98
65	20	9.98
100	20	12.98
150	20	14.98
12	32	12.98
25	32	14.98
50	32	16.98

Tungar Bulbs

16x897	3.49
199898	4.49
195528	2.49
20x672	2.95
208501	3.50
217283	6.75
289881	2.50
45X674	12.95
859483	2.95

Mazda Pilots

311/28V	.15
313/28V	.15
323/3V	.25

Neon Bulbs

NE16/991	.40
NE30	.10
NE32	.35
NE45/2W	.27
NE51/NE20	.10

Xtal Diodes

1N21	.89
1N21A	1.98
1N21B	3.98
1N21C	27.45
1N22	1.25
1N23	1.49
1N23A	2.98
1N23B	4.98
1N25	7.45
1N26	9.15
1N27	1.65
1N29	3.50
1N32	24.50
1N34	.69
1N34A	.98
1N35	1.95
1N38	1.65
1N39	6.15
1N40	9.98
1N43	1.69
1N44	1.21
1N45	1.39
1N46	.69
1N48	.59
1N51	.45
1N52	1.05
1N54	.89
1N55	2.99
1N56	.89
1N57	.89
1N58	1.19
1N60	.60
1N61	2.10
1N63/K63	2.49
1N64	.69
1N67	1.95
1N69	1.98
CK705	.77
CK707	1.80
CK708	.54

Thermistors

D167019 Vol Limiter 2.95
D168391 Thermal Comp 2.95
D170396 HF Pwr. Meas. .90
1C Bulb Time Delay .90

Varistors

CW20259/USN3BC 2.95
WEco 40A 1.50
WEco 41A 1.50

Money Back Guarantee (Cost of Mdse Only) $5 Min. Order FOB NYC. Add Shpg. Charges & 25% Dep. Tubes Gtd. via R-Exp. only. Prices Subject to Change Without Notice. Phone: WOrth 2-7230

THAT'S A BUY "TAB" THAT'S A BUY

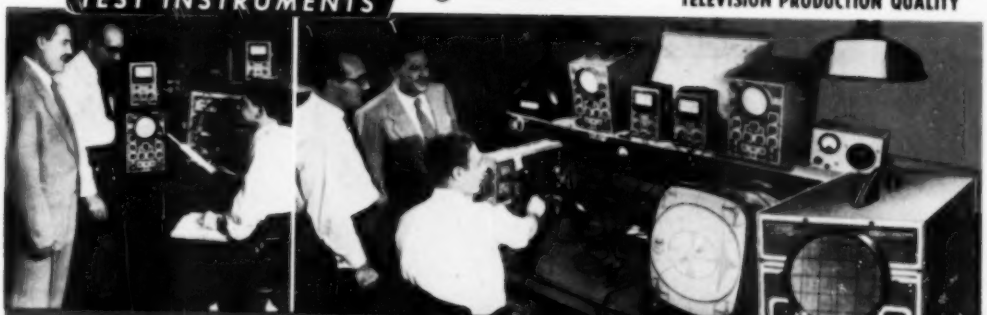
DEPT. 3RN. SIX CHURCH ST. NEW YORK 6, N.Y., U.S.A. - CORNER CHURCH & LIBERTY STS. ROOM 200

PRINTED IN U.S.A.

EICO TEST INSTRUMENTS

Guards Majestic

HIGH STANDARDS OF
TELEVISION PRODUCTION QUALITY



KITS - Wired Instruments

For Laboratory Precision at Lowest Cost— the Leaders Look to EICO!

WHY does The Majestic TV Division of The Wilcox-Gay Corp., another one of America's leading TV manufacturers, specify EICO Test Instruments on *both* its production lines and in its design laboratories?

BECAUSE —like Emerson, Tele-King, Tele-Tone, CBS-Columbia, and many another famous TV manufacturer coast to coast, Majestic knows that

ONLY EICO TEST EQUIPMENT DELIVERS ALL 10 EICONOMICAL FEATURES

1. Laboratory Precision
2. Lowest Cost
3. Lifetime Dependability
4. Speedy Operation
5. Rugged Construction
6. Quality Components
7. Latest Engineering
8. Super-Simplified Assembly and Use Instructions
9. Laboratory-Styled Appearance
10. Exclusive EICO Make-Good Guarantee

Before You buy any higher-priced equipment, be sure You look at the *EICO* line—*in Wired as well as Kit form!* Each EICO product is jam-packed with unbelievable value. YOU be the judge—compare, see *EICO instruments today* -- in stock at your local jobber — and SAVE! Write NOW for FREE newest Catalog 3-R.

FOLLOW THE LEADERS . . . INSIST ON



NEW 425K 5" PUSH-PULL SCOPE KIT $44.95, WIRED $79.95

NEW 221K VTVM KIT $25.95 WIRED $49.95



HIGH VOLTAGE PROBE $6.95









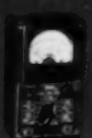














EICO

ELECTRONIC INSTRUMENT CO., Inc.
84 WITHERS STREET, BROOKLYN 11, NEW YORK

What's your unlucky day?



Bad luck—in the form of dissatisfied customers—can come your way any day in the month if you buy capacitors by rating only rather than by rating *and* brand. But . . . you can make every day a lucky day if you . . .

Make Sure! Make it Mallory!

Repair work that insures satisfied customers is yours every time if you always specify Mallory capacitors, because outstanding performance is built into *all* Mallory capacitors.



Mallory FP's are the only fabricated plate capacitors available to the replacement trade. And they are accepted as *the* top notch capacitors by the makers of TV and radio sets. Mallory FP's give long-lasting service even at 185° F. (85° C.).



Mallory Plascaps* are the first completely engineered plastic tubular capacitors. Always use them and avoid leakage . . . premature shorting . . . unsoldered leads . . . off-center cartridges. Count on Mallory Plascap as you do on Mallory FP's.

In the past 25 years, Mallory research and engineering work has resulted in a series of developments that give you capacitors which are smaller . . . more uniform . . . longer-lasting . . . more resistant to heat. Look to Mallory for future capacitor improvements. Order Mallory capacitors today and be sure.

Depend on your Mallory Distributor for quality products at competitive prices.



P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA